JUN 1 1 1943

The Welding Engineer

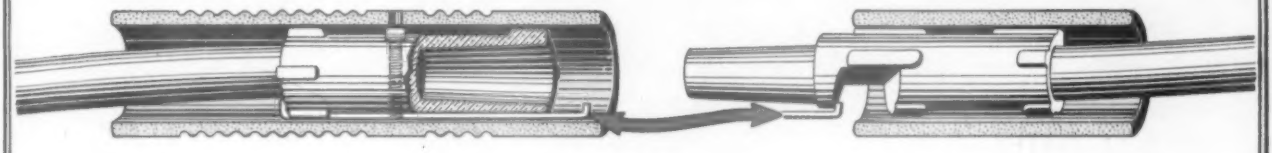
JUNE 1943

THE PIONEER TECHNICAL PUBLICATION OF THE WELDING INDUSTRY

Jackson's QUIK-TRIK CABLE CONNECTOR

Locks TIGHT, quickly unlocked

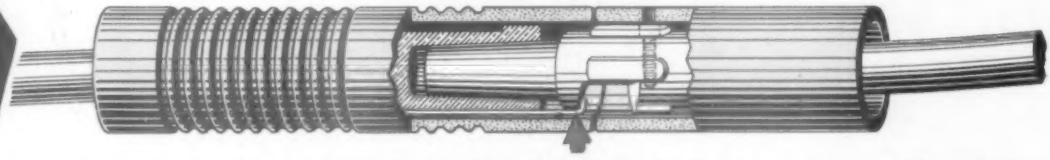
—fully insulated . . . SAFE



Female Section is soldered to cable lead Male Section is soldered to cable extension

Removable insulators are securely held in protective position with Allen screws.

HOW IT WORKS..



Connection is made by inserting Male Section into Female Section. Then, with a twist, the locking spring rides the cam into position holding both sections tight.

To unlock, simply twist apart.

PATENT APPLIED FOR

Important: Female Section, installed on cable lead, as shown above, may also be used as a handle and connected directly to the "Stinger" end of a Jackson Model TA holder as shown below. The adaptation saves time and material, eliminates the danger of live cable ends and makes possible the economies of standardization.

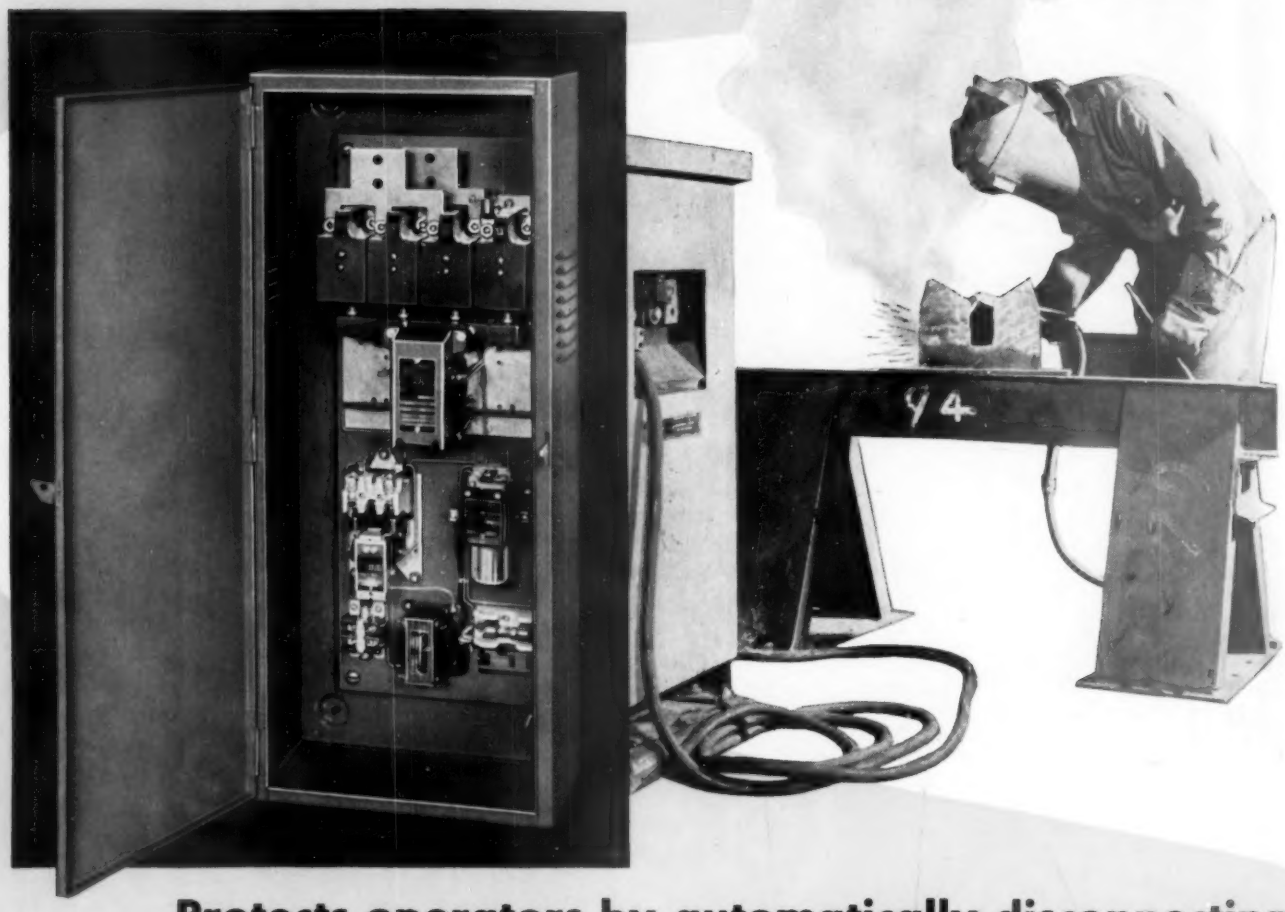
Contact your nearest Jackson dealer or write for Bulletins D and D-CC.

(above) Typical cable extension assembly for users of Jackson Model TA holders.

JACKSON PRODUCTS, 3265 Wight St., Detroit, Michigan

In Canada: Hollup Corporation, Limited, Toronto • Paragon Supplies, Limited, Vancouver

SQUARE D *Announces*
SAFETY CONTROL FOR A·C· ARC WELDERS



Protects operators by automatically disconnecting welding transformer when arc is broken . . . .

HIGH open circuit voltages of A. C. arc welders (transformer type) create a definite hazard to operators. Physical contact from electrode to grounded metal surfaces (when not welding) is sometimes serious.

Square D's new class 8992 safety panels eliminate this hazard by automatically disconnecting the welder transformer after the arc is broken. The transformer is automatically reconnected the instant the operator touches the electrode to the work. Thus, the arc is struck with no delay. There is no loss in operating speed or efficiency.

There is an economy angle, too. When Square D safety panels are used, the welding transformer primary circuit is connected to the power line only while the arc is held. Substantial saving in power is effected when a number of welders are used on a single power system and the power factor is improved.

These new safety panels can be used with any make or model of A. C. transformer type arc welder. External connections are simple and internal connections of the welder need not be disturbed.

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SQUARE D COMPANY

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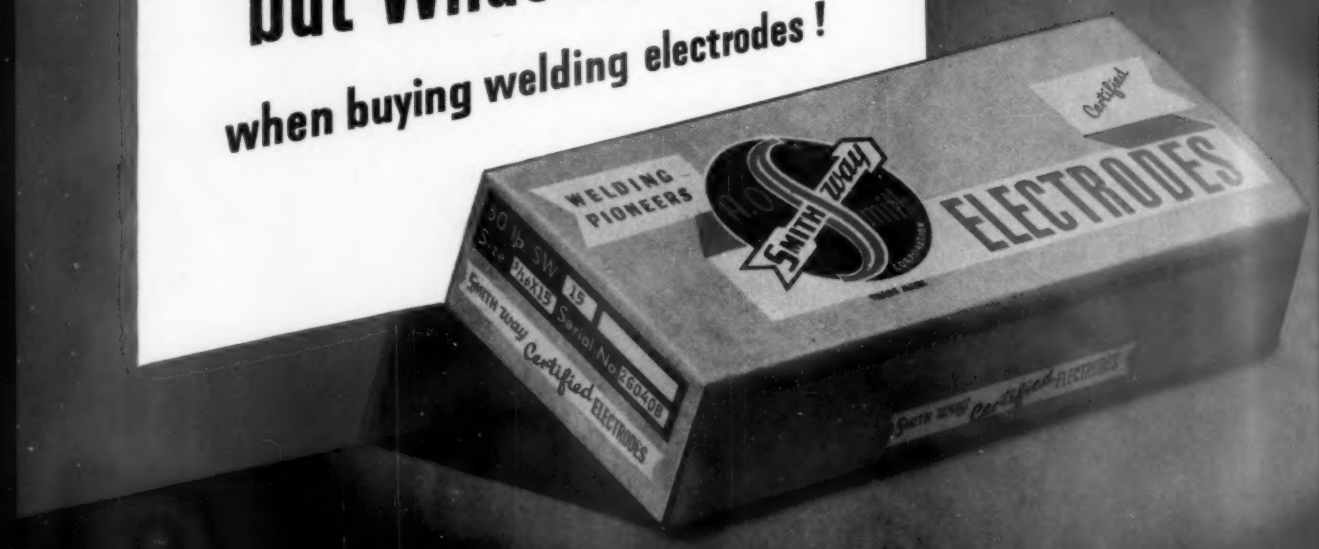
Not What You Pay but What You GET

when buying welding electrodes!



☆ *IF* all welding electrodes of the same type were exactly alike, or even very similar, there would be no question as to which to buy.

But welding electrodes are *not* alike. They are not even "very similar." We know this to be a fact, for we spent several hundred thousand dollars to discover it. Our laboratory and shop tests reveal with definite finality that the price per pound of electrodes does *not* determine the *material* or the *time cost* of welding. Both of those figures are governed by what you *get* from electrodes—not what you pay per pound.

With us, welding electrodes are *production tools*. We manufacture the SMITHway Certified Welding Electrodes used in our plants in order to assure the quality, the uniformity, and the characteristics essential to more *good* welds per man-hour. We offer others who do welding the same electrodes.

If you feel that there is little if any difference in welding electrodes, we think we can *prove* that the price you pay for SMITHway Certified Welding Electrodes *buys* considerably *lower welding cost*—and considerably *better welding results*.

Mild Steel . . . High Tensile . . . and Stainless Steel

WELDING ELECTRODES

Made by welders . . . for welders

SMITHway Welding Monitor: *cuts time cost of training welders as much as 33⅓% by automatically signaling operator when correct feeding speed is or is not being maintained.*

SMITHway AC Welding Machine: *no arc blow; reduces spatter losses; effects worthwhile overall power saving; gives more good welds per man-hour.*

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The Welding Engineer

AMERICA'S PIONEER WELDING JOURNAL

Established 1916

The Mobilization of Brains

Many laws and proposed laws have come out of Washington in recent years. Some have been good and necessary. Others, however, have been just the opposite, while a few can be described by no other adjective than "ridiculous."

A pending bill which might fall in the last category were it not for its serious implications is Senate Bill S.702. S.702 or the Science Mobilization Bill was introduced by Senator H. M. Kilgore and is now in the hands of the Senate Committee on Military Affairs.

According to the wording of the bill, it will "in periods of peace or war," that is from now to eternity if the bill becomes a law, provide for the establishment of an office which among other things will:

(1) Mobilize scientific and technical facilities for national defense.

(2) Promote, coördinate and develop projects, methods, training and data.

(3) Advise the President and Congress on scientific and technical matters.

(4) Promote the establishment of standard specifications and designs.

(5) Acquire patents and patent rights and authorize their use on a non-exclusive basis.

To accomplish this program, the bill provides a fund of $200,000,000. The administration of this fund will be in the hands of a board which includes a chairman at $12,000 a year and 6 members at $10,000 a year, all appointed by the President.

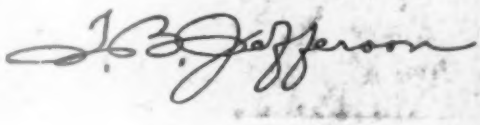
The members shall include "one representative each for industry, agriculture, labor, the consuming public, and two additional members at large who should be scientists or technologists." A scientist or technologist is defined by the bill as "all persons . . . who had not less than an aggregate of 6 months training or employment in any scientific or technical vocation," a definition sufficiently broad to include everyone in the country over eight years of age.

The most serious part of the bill is mobilization. Lots has been said about mobilization, about regimentation and about the four freedoms. Those promoting freedom will agree that freedom is quite a different thing from either mobilization or regimentation. The mobilization boys contend that mobilization has no effect on freedom. As for regimentation, conquered Europe has learned that mobilization is the first step toward regimentation.

Senator Kilgore has defined mobilization for us. He says that "mobilization is the organizing of a group for a common cause without threats of compulsion or penalty," and he adds that "when a group is organized by compulsion it is regimentation."

The Senator is an authority on the subject inasmuch as he has introduced several mobilization bills. In S.702, however, we are advised that "Any person who willfully violates any order, rule or regulation promulgated by the Administrator under this act shall, upon conviction thereof, be fined no more than $5,000 or imprisoned for not more than one year, or both." Is that mobilization or regimentation?

The Senator has a lot to learn about scientific endeavors—and about human nature. First, all scientific activities must involve thought, and brains can't be regimented. There is only one person capable of mobilizing thought and that is the individual who is doing the thinking. Any attempt to regiment the thinking of the scientific mind cannot help but mean the stopping of scientific achievement.



THE SAME METHODS WILL WIN YOUR POST-WAR BATTLES

Since welding is taking such a big hand in winning the war, why shouldn't I watch it closely for ideas to win my battles for business after the war?

ALTER EGO: That's logical. Where you see welding, you see faster production and far better ships, planes, tanks and guns. The same basic methods can be used after the war to cut costs and build better autos, machines, appliances and buildings.

Can I get any ideas from the wartime gasoline tanks they're welding here?

ALTER EGO: Sure! In the first place, they're welded. And they're welded fast. Ever hear of welding 10 to 14-gauge sheet with 3/16" electrode? Usual practice requires 1/8" or 5/32" size. This shop developed fit-up jigs and positioning fixtures to allow the 3/16" size. *This bigger electrode saves them 33% in man-hours.*

Then, the big problem is not only to find ways to apply welding to my post-war products, but to find ways to beat competition on the cost of my welding.

ALTER EGO: You're right. You should use this double approach to post-war profits by keeping an eye on the big war-job welding is doing . . and by all means, ask for Lincoln cooperation on design and production.

THE LINCOLN ELECTRIC COMPANY
CLEVELAND, OHIO

then I said to myself—

THERE'S ALWAYS SOMETHING NEW UNDER THE ARC

Fig. 1—Ten-tube cluster joint with a 7 in. diam cast steel sphere. This joint has very good structural properties, and it eliminates eccentricity between the members.

Welding Tubular Structures

For structures that require a maximum rigidity with a practical weight minimum, the tube-and-sphere design is recommended because of its simplicity, accuracy of fitting, steel conservation and speed of construction.

By **FORREST WALDO**
Applied Engineering Dept.,
Air Reduction Sales Co.

STRUCTURES built of steel tubing and employing welding throughout offer such outstanding advantages in rigidity and weight saving that it is difficult to understand why this tubular design is still so infrequently used. Cost was an important factor in the past, but today's steel shortage puts a greater premium upon a pound of steel than a dollar. For structures requiring maximum rigidity with a practical minimum of weight, the welded tube design is not only one of the simplest but one of the most conserving of steel. It is also highly pleasing to the eye.

Particular types of structures, because of their service function or for other reasons, benefit most from this form of construction. Best known among such structures is perhaps the airplane fuselage, many of which utilize thin-walled steel tubing to withstand the severe stresses of combat flight. In another category are the jigs upon which airplane wings or other mass-fabricated structures are assembled.

Tube-and-Sphere Designs

Joint designs for tubular structures may be made by cutting the tube ends to fit the contour of adjacent members and incorporating web plates or other stiffeners into the joint. However, the cutting of these end profiles sometimes becomes quite involved when the number of tubes meeting in a single cluster is large. In such cases, the spherical-type joint, Fig. 1, is advantageous, for it eliminates a great part of the necessity for cutting complex intersections. Because of the fact that the axis of the tube is directly in line with the center of the sphere, most tube ends may be cut off square. The square ends require less welding, and the whole joint is much simpler

and more accessible for both welding and inspection than the fitted joints.

Ship Model Carriages

Two unusually compelling examples of welded tubular structures employing spherical joints are illustrated in Figs. 2 and 3. The smaller carriage, Fig. 2, measures 28 ft between wheels.

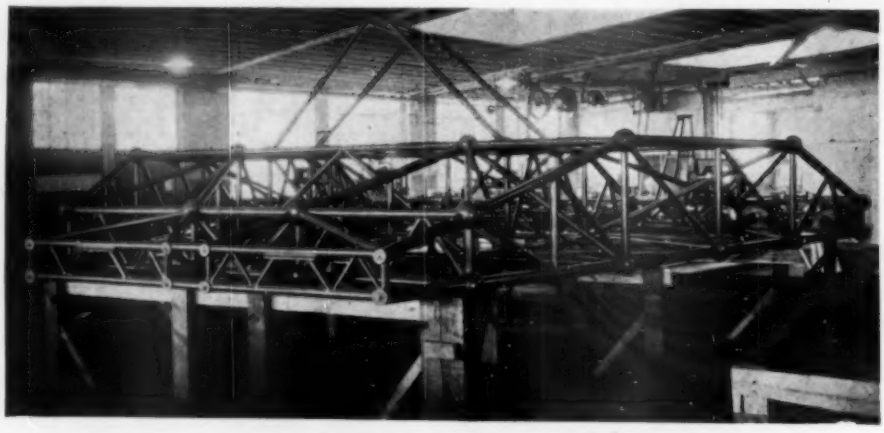


Fig. 2—The welded tube construction of this ship-model towing carriage provides extremely high rigidity with minimum weight. Spherical joints simplify the construction operations. The carriage has a 28 ft span and weighs only 8 tons.

Of the larger carriage, only the side truck or drive girder is shown, Fig. 3. Fabricated by C. Frederick Wolfe, Inc., Brooklyn, these towing carriages are for installation at the David Taylor model basis at Carderock, Md., where they will be used in the testing of ship models.

Construction requirements for this service are extraordinarily rigid. In use, the carriage is mounted on rails spanning the half-mile-long testing basin and is driven at speeds up to 40 knots (46 mph) while towing the small model ship. The wheels are powered individually by four hydraulic motors, which are driven by circulating oil from a single oil pump. The pump, in turn, is driven by an electric motor through reduction gears. Instruments for measuring and recording the hydrodynamic characteristics of the model are mounted on the carriage.

An indication of the precision of the entire set-up is shown by the fact that the rails on which the carriage travels were laid to correspond exactly with the earth's curvature. The rails were ground, polished and are oiled frequently in order to prevent oxidation. The four carriage wheels were ground to within 0.0005 in. of true diameter. No super-streamlined automobile ever rode as smoothly as these towing carriages. The engineers who ride on them would feel a perceptible jar if the machine rolled over a piece of paper laid on the rail. Obviously, the requirements of strength and rigidity, as well as dimensional precision, are almost unconditional for such welded structures.

Accurate Cutting Essential

Once the design had been established, the two greatest essentials in the building of these carriages were: (1) the accurate cutting and line-up of each tube length and (2) the progressive elimination of distortion during welding.

An ingenious method used for cutting the end contours on some of the tubes is shown in Fig. 4. A permanently mounted machine cutting torch was employed in conjunction with a sleeve template. The template was slipped over the end to be cut and held tightly in place as it was pressed against the torch tip. The sleeve then served as a guide while the operator slowly rotated the tube on roller dollies. The tube was flame-cut 1/8 in. long to allow for final milling, Fig. 5, to within 1/64 in. of the required length.

Spherical Intersections

All primary intersections of tubes in this assembly are of the spherical type. The spheres are cast steel shells of 0.25% or less carbon content, which insures good weldability. Internal strengthening is provided by a diaphragm and webbing.

The smaller carriage shown in Fig. 2 uses spheres of 7 in. diam with tubing of sizes ranging up to 3½ in. diam. The large carriage employs larger diameter spheres at principal joints. The side truck of the carriage shown in Fig. 3 is 60 ft long and weighs six tons, considerably less than would a comparable structure made of rolled shapes. This truck offers an excellent example for description of the procedures used to eliminate distortion during welding.

In the first stages of assembly (as in welding individual panels of the structure), the tasks of aligning members, skip welding and checking for fairness were simple enough. But as the structure began to assume size and shape, it was necessary to devise a means for holding it that would function in the manner of a welding jig. To accomplish this objective, supporting timbers and hold-down tie bolts were used in a combination functioning in both the vertical and horizontal planes. As shown in the illustration, Fig. 3, the tie bolts were anchored to the concrete floor at four points along the structure to hold the girder down against the wooden supports. Similar anchoring of the structure to the wall of the building is provided by two long bolts, one at each end, operating

Fig. 3—The drive girder of a larger carriage than that shown in Fig. 1. At extreme right, this girder or side truck is joined to the bridge section, of which only a few members are shown. Note the tie bolts anchored to the floor.

Fig. 4—Flame-cutting the end contour of a tube with a sleeve template. The operator simply rotates the tube while holding the template tightly against the cutting tip.

Fig. 5—After cutting the joint, profiles are milled to insure an accurate fit-up. The use of spherical joints permits most tube ends to be cut square, thus simplifying the cutting and machining problems.

against a timber compression member midway between them.

Taking Up Shrinkage

A surveyor's level was employed to check the alignment of the assembly as welding progressed. The tie bolts were loosened periodically during welding while a check sight was made with the level focusing on previously sighted "benchmarks" such as the upper surface of a horizontal tube. According to the degree of distortion indicated by these readings, a few shims would be inserted or removed between the lower tube and the supporting timbers and the tie bolts again clamped down. By this procedure, shrinkage was taken up progressively through judicious skipping of welds.

As finally welded, the 60 ft girder showed a deviation of only 1/16 in. in the vertical plane. Similar near-perfect alignment was obtained horizontally except for a camber of ¼ in. that was left in the sections where the bridge part of the carriage was to be welded to the girder. At the time of installation this camber disappears.

Tubes Nitrogen Filled

Each carriage is protected against corrosion within the tubes by nitrogen. This inert gas fills the entire tube network and is sealed in under a pressure of 3 psi. Before welding, small holes were drilled wherever necessary in the spheres and in tube walls so that all trapped air spaces would be interconnecting. The joint welds were tested for air leakage by the soap bubble method. When the tube system had been pronounced air tight, the air in it was evacuated.

A high quality of weld metal was secured by using electrodes conforming to requirements of ASTM-AWS Classification E-6010 of Specification A233-42T. The electrodes used were for all-position welding at a high deposition rate with D-C reverse polarity. Classification E-6010 calls for a ductility of at least 22% as welded and a minimum tensile strength of 60,000 psi. The high ductility of welds is the most essential characteristic for the towing carriages.

These welded tubular structures illustrate the simplicity of such fabricated assemblies. The primary advantage gained by the welded tubular design lies in its weight-strength ratio, which is important not only in these carriages but in other applications where cost is subordinate to reduction of weight and conservation of metal. The use of spherical members at the joints is not essential, of course, but it does promote both speed and accuracy of construction.

★

Handy with the Welding Torch

PERSONNEL managers who are still wondering whether a woman can do the welding job of a man might find the answer in the work of Mrs. Martine Heilmann, outstanding weldor at the Porcelain Metals Corp., Louisville, Ky. This lady works at the side of skilled male weldors, doing difficult gas welding on ordnance and special defense housing projects. Her work is satisfactory, the foreman reports, and she is able to keep up a production rate equal to that of the men.

Two years ago Mrs. Heilmann decided that, besides managing her home, she should be doing war work. She tried several jobs but liked welding the best. Because of her unusual success at this job, she was chosen to represent Porcelain Metals employees in a recent interview over station WGRC, Louisville, when her company was awarded the Army-Navy "E".

This woman weldor does a man's job at Porcelain Metals Corp., Louisville, Ky. She joined the production army two years ago when her company was beginning to convert for war contracts.

Metallizing for P

It might be well for the welding shop operating under present conditions to look toward metallizing as a supplemental tool for maintenance and conservation. Worn parts can be built up or protection given against the ravages of corrosion by means of this versatile process.

By **CLYDE B. CLASON**

AN EXCELLENT aid to conservation and maintenance is being overlooked by those who fail to take advantage of the opportunities afforded by metal spraying or, as it is more commonly known, metallizing. This versatile tool has almost innumerable uses.

Metallizing combines the oxy-acetylene (or other oxy-gas) flame with compressed air in order to deposit a layer of minute metal particles upon either a metallic or non-metallic surface. Among its principal applications may be listed the following:

(1) New metal may be added to worn or mis-machined surfaces in order to build up a part to its required dimensions.

(2) A layer of protective metal may be deposited over a less expensive metal to increase wear resistance.

(3) A layer of corrosion-resistant metal may be laid to protect against the corrosive effects of the atmosphere.

(4) Containers may be coated to minimize the effects of corrosive liquids or gases.

(5) Increased service at high temperatures may be given by the deposition of sprayed aluminum to form a refractory layer of aluminum oxide.

(6) Metal may be bonded to carbon or to porcelain and other non-metallic dielectric materials for specific purposes.

(7) Blowholes, sand holes or gas holes in defective castings may be filled with sprayed metal.

(8) A reflecting metal surface may be deposited upon glass.

(9) Many varied decorative applications are possible.

A Typical Plant

How metal spraying may be used as an important and profitable addition to an established business is proved by the Metallizing Division of the Motive Parts Company of America, Inc., 3114 S. Shields Ave., Chicago. This division of Motive Parts specializes in the rebuilding of worn machine parts and the deposition of corrosion-preventive and heat-resistant coatings. Among the products handled in this plant are: crank shafts, bearings, printing rolls, trailer axles, steering knuckles, automotive hubs (built up where bearing cup has come loose), ice machine shafts, degreasing tanks (coated with zinc), laundry machinery, ice cream factory parts (zinc or tin coated), containers of various sorts and sizes, and magnesium melting pots.

To meet the diversified demands of the firm's clients, metallizing wires are carried in stock suitable for spraying the following materials: aluminum, Babbitt metal, bronzes (commercial, Tobin, phosphor and Tufton), copper, lead, Monel, nickel, Swedish iron, solder, 0.10% carbon steel, 0.25% carbon steel, 0.40% carbon steel, 0.80% carbon steel, 1.20% carbon steel, No. 1 stainless steel (18-8), No. 2 stainless steel (high carbon, high chromium), Tufton steel (low chromium), tin and high purity electrolytic zinc.

Corrosion-Resistant Metals

Aluminum is used for common anti-corrosive use in such applications as hot water storage tanks, vegetable oil tanks, bubble towers, gas engine mufflers, etc. It is also used to increase the life of equipment subjected to high temperatures such as furnace parts, melting pots, crucibles, ladles, salt pots and annealing boxes.

Tin is recommended for tank linings and, particularly, for containers of any kind which are to hold food products. Zinc serves to safeguard against atmospheric or fresh and salt water corrosion.

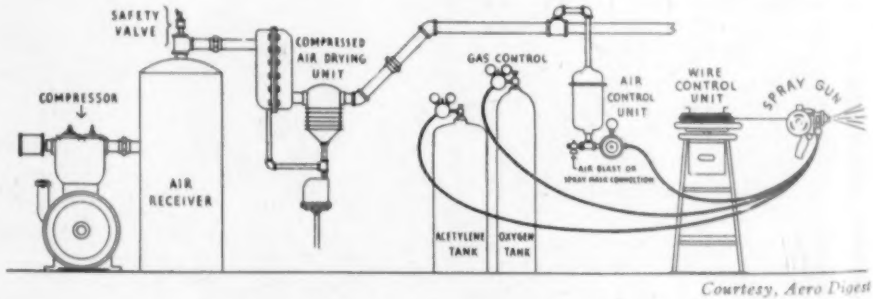
Lead is also used for anti-corrosion purposes, serving for such parts as battery connecting straps where protection is required against acid fumes.

Copper is used for electrical conductivity and for special work requiring copper. The bronzes, nickel and Monel metal have well known corrosion-resistant applications. No. 1 stainless steel provides high corrosion resistance and good wearing qualities, and No. 2 stainless is recommended where a harder corrosion-resistant material is required.

Babbitt metal A (tin base, lead free) is recommended for heavy-duty bearings. Babbitt metal L (lead base) may be used for light duty and special production work where cost is important.

For Building up Surfaces

Mild carbon steel (0.10% C) is used for building up surfaces on which ease of machining is a paramount requirement. The 0.25% carbon steel is recommended where a



Courtesy, Aero Digest

Fig. 1—Schematic set-up of metal spraying equipment.

Fig. 2—Spraying 1.20% carbon steel on a large GMC crank shaft in order to provide increased wear.

harder steel yet with good machineability is required. The 0.40% carbon steel is the hardest sprayed steel that can be machined.

The 0.80% carbon steel, perhaps the most widely used hard steel for metallizing work, must be finished by grinding. It gives a hard, wear-resistant coating and is used on crankshaft bearings, pump plungers, piston rods, seal rings, etc. The 1.20% carbon steel may be sprayed on parts for which a slight additional hardness is desired.

Advantages and Disadvantages

The structure of a metallized coating is somewhat porous, but this porosity is far from being a disadvantage. The minute pores of the coating provide numerous tiny reservoirs for lubricants, thus adding greatly to the life of a bearing surface. Some sprayed metal bearing surfaces have had several times the life of the original bearing.

Another advantage of metallized deposits is that the base metal rarely gets hotter than 200 F. so that there is no danger whatsoever of warpage or heat distortion.

The chief disadvantage of metallizing, if it may be called such, is that the deposited metal is not fused or welded to the base metal but joined by a purely mechanical bond; *i.e.*, the interlocking of innumerable metal particles. This bond is not capable of withstanding a greater direct pull than 500 psi. Because the weight of the metallized coating increases with its thickness and so throws a greater load upon the mechanical bond, the thickness of the deposited layer is limited to 0.045 in. on flat surfaces. This limitation does not hold for cylindrical surfaces, on which virtually any thickness of metal can be sprayed because of the continuous inter-crystalline bond of the metal particles.

There are three chief methods for preparing a surface for metallizing: blasting with steel grit, rough threading (sometimes coupled with the use of a rotary shaft preparing tool) and the fusing of a rough deposit of electrode metal onto the surface to be metallized. The last-mentioned method, known as the "Mogul Electric Bond" or "Fuse-Bond" process, is comparatively new and was developed primarily to prepare electro-hardened, heat-treated and chill cast

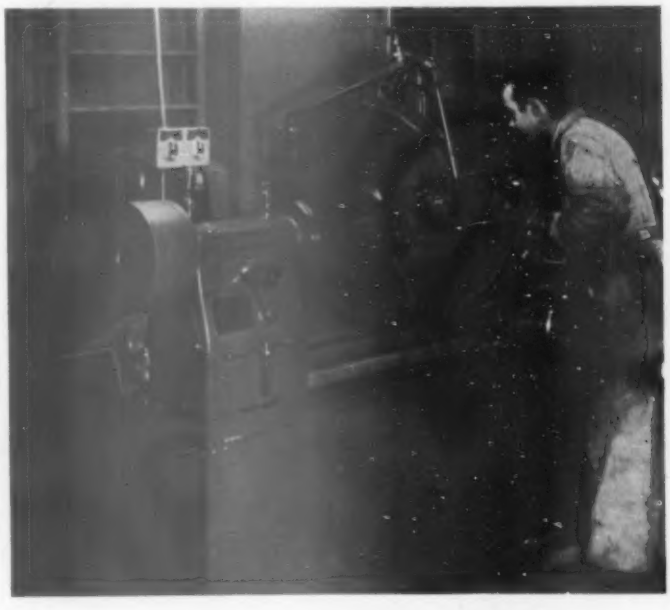


Fig. 3—The grinding room of the Metallizing Department, Motive Parts Company of America, Inc. The big grinder can handle work up to 22 in. in diam and swing 108 in. between centers. Precision grinding is done to any tolerances that may be specified.

Fig. 4—Metallizing a cylinder for a large marine Diesel engine.

iron surfaces for metallizing; however, it can be used for all metal surfaces and will give a satisfactory bond, according to metal spray equipment manufacturers. The electrodeposition method of preparation is as fast as rough threading.

Grit Blasting

The use of the proper blast cleaning material is extremely important. A common error, which has resulted in unsuccessful metal spray applications, is that of using a fine blasting material such as sand. Sand blasting tends to produce a polished instead of a roughened surface, making it difficult to obtain a good mechanical bond. For best results, steel grits should be used. Flint grits may be substituted, however, in warm coastal areas where the salt air causes steel particles to rust almost overnight.

At the plant of the Motive Parts Company of America, Inc., preparation is confined to grit blasting for surfaces of comparative flatness and rough threading for objects which can be swung in a lathe. The blasting department is a specially built chamber with steel-plated walls and floor, and those doing this exacting work are required to wear respirators, protective hoods and heavy clothing. Compressed air is used at a pressure of 80 to 125 psi to impel steel grits through an air nozzle against the surface to be blasted.

The steel grits are angular and have sharp cutting edges. By turning the blast nozzle at various angles, undercut "caves" and overhanging "crags" are formed all over the prepared surface to provide a multiplicity of minute keys or locks for securing the molten metal particles projected from the spray gun. Without such anchorage, a good mechanical bond between coating and metal cannot be developed. Once an area has been blasted, it must be sprayed just as soon as possible before surface oxidation which might weaken the bond can occur. Needless to say, the prepared surface must be cleaned from dirt and grease and kept clean prior to spraying. It should not be handled except with clean cotton gloves.

Rough Threading

Cylindrical parts such as shafts, studs, rods, spindles, bearing surfaces, pump plungers and rolls may be prepared on the lathe instead of in the blasting chamber. The surface of such parts is first undercut to clean out the worn areas and provide sufficiently for the thickness of the metallized coating. The part is next thoroughly cleaned and degreased and finally rough threaded.

In the latter operation, 24 threads per inch are cut with a lathe threading tool that has had its side clearance ground away and the point slightly rounded. The point of this tool is set about 1/16 in. below the center of the work so that a torn thread will be obtained, giving thousands upon thousands of minute "keyways" into which the flying metal particles can lock themselves to form a firm bond.

This method of preparation, if well done, will provide a surface satisfactory for metallizing practically all plain carbon steel shafts. Rough threading is sometimes supplemented, particularly for bronze, brass or nickel-steels, by use of the rotary shaft preparing tool. This tool is mounted in the lathe slide rest and run back and forth over the shaft in order to roughen the tops of the ridges and to spread the ridges apart and thus form dovetail grooves. A surface prepared in this manner is satisfactory for any metal.

Non-Metallic Surfaces

Sprayed metal may be applied without preparation to any non-metallic surface that is clean, rough and dry. Such materials as unglazed pottery, terra cotta, concrete, brick, plaster, wood, paper and cloth are sufficiently rough for spraying in their natural state. Carbon likewise needs no preparation, but glass, in order to secure a good bond, should be heated close to its plastic state and the metal sprayed directly upon the hot glass. Ceramics should also be heated before the metal is applied.

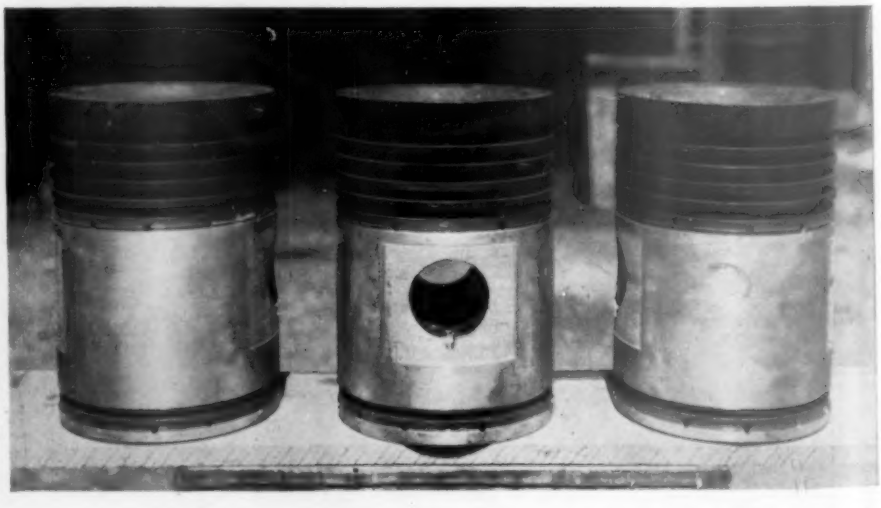
Equipment for Spraying

Metallizing proper, as distinct from the preparatory work, requires a spray gun of the self-contained portable type, a compressed air supply of at least 30 cfm at 60 to 80 psi pressure, an air separator to filter out water, oxygen cylinders and cylinders of acetylene or other fuel gas, pressure regulators for compressed air, oxygen and acetylene, and a turntable reel stand for holding the spools or coils of wire fed into the gun. The arrangement of this equipment is shown in Fig. 1. The most recently developed guns will handle any size of wire from 24 B&S gauge to ⅛ in. and may be quickly regulated to be operated with different fuel gases.

Operation

When the wire of spraying metal is fed into the gun, it passes between two knurled rolls driven by a small air turbine and is propelled at a preset constant speed into the nozzle. The metal is melted by the oxy-acetylene

Fig. 5—Diesel pistons for the engine running an oil well drilling rig. These were metallized with zinc at the General Metallizing and Machine Co., Houston, Texas.



Courtesy, Metallizing Co. of America

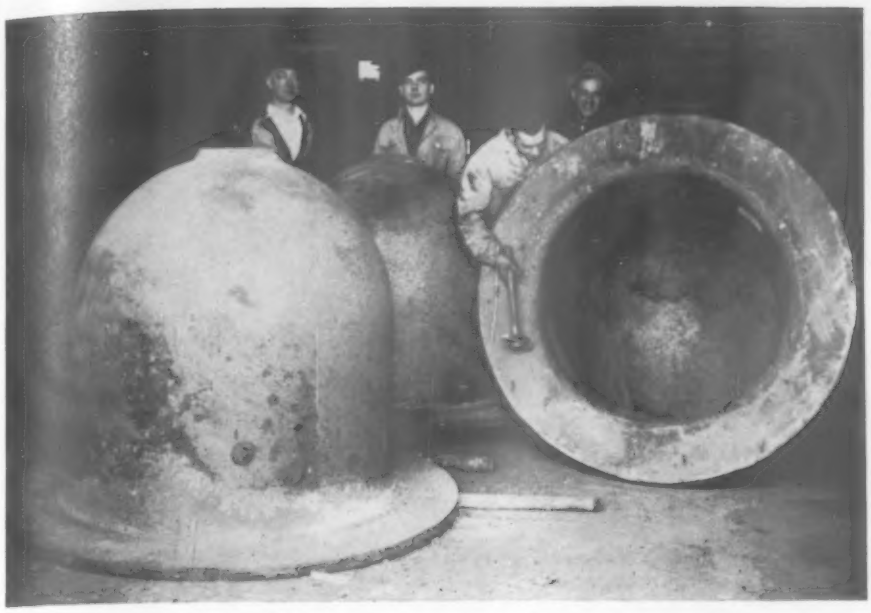


Fig. 6—Magnesium melting pots ready to be coated with a heat-resisting metal (aluminum).

flame—not inside the gun but at a point from ⅛ to ½ in. beyond the air cap—and discharged by air pressure in a microfine spray.

When the oxy-acetylene flame is the heat source, a neutral flame should always be used. Use of either an oxidizing or carburizing flame will slow down the spraying speed and will also, for steels, change the carbon content of the sprayed metal.

Pressure of air, oxygen and acetylene must be carefully regulated to meet the requirements of the particular work being done. In the majority of cases, the most economical performance is given by a consumption of 35 cu ft of acetylene per hr at 15 psi and 45 cu ft of oxygen per hr at 17 psi. The air pressure varies up to 80 psi, depending upon the particular metal being sprayed and other factors. Average spraying speeds in lb of metal deposited per hr for ⅛ in. wires are given in the following table:

Babbitt	34.0
Zinc	24.7
Copper	13.3
Bronzes	16.2
Brasses	15.0
High carbon steel	9.2
Medium carbon steel	8.7
Monel	8.5
Stainless steel	8.3
Low carbon steel	8.0
Iron	8.0
Nickel	7.9
Aluminum	6.3

The gun may be either manually operated or mounted in the lathe tool post to spray objects that can be swung between centers. In both cases, the gun should be held from 3 to 6 in. from the work, depending upon the metal being sprayed. Before the gun is mounted on the lathe, it should be held at an angle and the work alternately sprayed from each side in order to deposit the sprayed metal underneath the dovetails. The gun is then mounted in the tool post holder, and the balance of the coating is applied at a 90 deg angle to the work.

Finishing

As deposited, sprayed metal has a rough, dull, "sandy" appearance. Machining or grinding, however, quickly imparts the natural metallic luster. For steel having a greater carbon content than 0.40%, machining is not practicable and grinding must be done instead. Wet grinding is preferable, whenever practicable.

The accompanying photographs, reproduced through the courtesy of C. N. Bradley, manager of the Metallizing Division of Motive Parts Company of America, Inc., show a number of interesting examples of metallizing applications.

In Fig. 2, 1.20% carbon steel is being sprayed by two men on a large GMC crank shaft. The crank shaft will afterwards be ground to specified tolerances on the large wheel shown in Fig. 3. This grinder can handle work u pto 22 in. in diam and swing 108 in. between centers. It is used for both offset and straight shaft finishing.

Fig. 4 shows the cylinder of a large marine Diesel engine being metallized. It will be ground back to standard size after the layer of new metal has been deposited. In Fig. 5 are three 9 in. diam pistons which were metallized with zinc; these are used in an engine that runs an oil well drilling rig.

Fig. 6 shows three cast iron pots for melting magnesium. These pots weighed 4,800 lb each and had to be lifted with a block and tackle and pushed with a truck in order to roll them around the shop. Each pot was coated with a layer of heat-resistant aluminum.

Decorative applications, though of merely academic interest at present, are expected to come fully into their own after the war ends and metals become once more available for normal peacetime pursuits. In Fig. 7 a decorative panel is being prepared by spraying a layer of bronze over wood. Bronze or other "art" metal can likewise be inexpensively sprayed over a plaster of Paris image to produce a statuette which appears to be of genuine metal throughout.

Fig. 7—A typical decorative application. Metals can be sprayed on other metals or on non-metallic substances such as wood, plaster of Paris, leather, glass, unglazed pottery, etc.

Fig. 1—Welded sign made by pupils of the Des Moines War Training School.

By **JOHN G. SHERBO**
Supervisor, Welding Div., War Training School, Des Moines, Ia.

Training for War Industries

The ingenuity and patience of those in charge of our War Training Schools have been little short of marvelous. Here is the inside story of how the Des Moines school is turning out finished men and women weldors.

When the full history of the present war is written, an important chapter will have to be about War Training Schools—whose work throughout the country is in no small degree responsible for the victory on the production line that is today breaking the backs of the Axis powers in Africa, Europe, and Asia.

Weldors in Weeks

In training men and women from all walks of life to work alongside of men whose skill has been developed through years of experience at one particular job, these schools have been and are doing a magnificent work. Many of the pupils, though more than eager to do their share in the war effort, are past the age when learning a new trade is easy. Yet from such material, men and women are being trained in a few weeks' time to do precision machine work or welding which compares favorably with that of an expert.

From the particular school with which I am associated, qualified weldors stream constantly to arsenals, shipyards, bomber plants and to all types of industry where welding is employed. From coast to coast and border to border go our weldors, many being sent even outside the boundaries of the United States. Certainly the training of these men and women represents a very important contribution to our nation's final victory over the Powers of Darkness!

Their Own Boot Straps

This school started out with eight arc welding booths and 16 oxy-acetylene welding stations. Soon the enrollment of students had increased to the point where it was necessary to expand our facilities. We hoisted ourselves by our own boot straps, so to speak, by letting advanced students build 16 additional arc welding booths and 56 more oxy-acetylene welding tables. Thus they learned welding while making it possible for many others to learn after them.

One of the chief problems confronting the welding supervisor of a War

Fig. 2—Ten-ton iron rack welded from old bed rails.

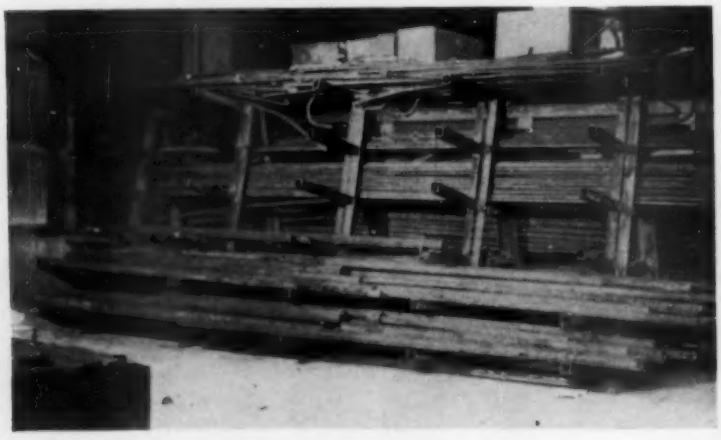


Fig. 3—Welding sample display rack.

Fig. 4—Twelve-ton welding rod rack.

Training School is that of getting proper materials on which the various practice welds can be made. Many of these materials require a high priority rating, and to order them from the suppliers necessitates a long delay before the order can be filled. Hence we use scrap whenever possible.

A local steel company furnishes us with steel plate scrap, but this is not always available. To supplement it, we scour the nearby junk yards for old pipe, angle irons, sections of tanks, old steel bed rails and any other weldable materials that can be obtained. So far we have managed to find enough scrap of one kind or another to keep all of our student weldors occupied.

Busy with Bed Rails

Our coördinator, Mr. Schollenberger, in his never ceasing quest for materials, was fortunate enough to locate several hundred old steel bed rails at one of the local junk yards. To date, we have used over five tons, and out of them we have built our welding tables, work benches, display racks, anvil bases, stools and rod racks, iron rack and even the sign shown in Fig. 1. Erected on a corner of the school grounds, this sign makes a very attractive advertisement for the school. The machine shop cut the outline letters appearing at the top with a contour saw.

An iron rack, welding sample display rack and welding rod rack—all likewise made from old steel bed rails —are shown in Figs. 2, 3 and 4. The number of ways in which these old rails can be used is certainly surprising. As one of the students remarked, "All we need is an idea and a few bed rails, and we can make it." Where additional strength is required, the rails can be doubled or formed into any of the designs shown in Fig. 5.

Meeting Electrode Shortages

At first it was no problem at all to secure good quality coated electrodes for arc welding. Later, as a scarcity of high quality rods developed, we used seconds and salvage rods. In the latter category were many containers of coated electrodes which had been water soaked and were stuck together in a solid mass. We beat these apart, soaked off their coatings and used them as bare electrodes or even as filler rods for oxy-acetylene welding. Despite the various expedients to which we have been forced to resort, I am glad to say that the stream of qualified weldors going to war industries has never once been broken.

A question that we have been asked many times is: "What will become of all these weldors after the war ends?" There seem to be as many ideas on the subject as there are minds to advance them, but I personally do not believe that the postwar future of welding is going to be nearly as dark as many seem to think.

The men and women who have taken our welding course can be classified into two distinct groups. Group I consists of those who have taken up welding temporarily, either because they have lost former positions or because of a sincere desire to help with the war effort. These men will undoubtedly go back to their former occupations when the war ends and conditions get back toward normal.

In Group II will be found the men for whom the war training courses were an opportunity to realize an ambition of long standing to get in the welding trade. This group intends to make welding a permanent career and will not return to other pursuits unless forced to do so by economic pressure.

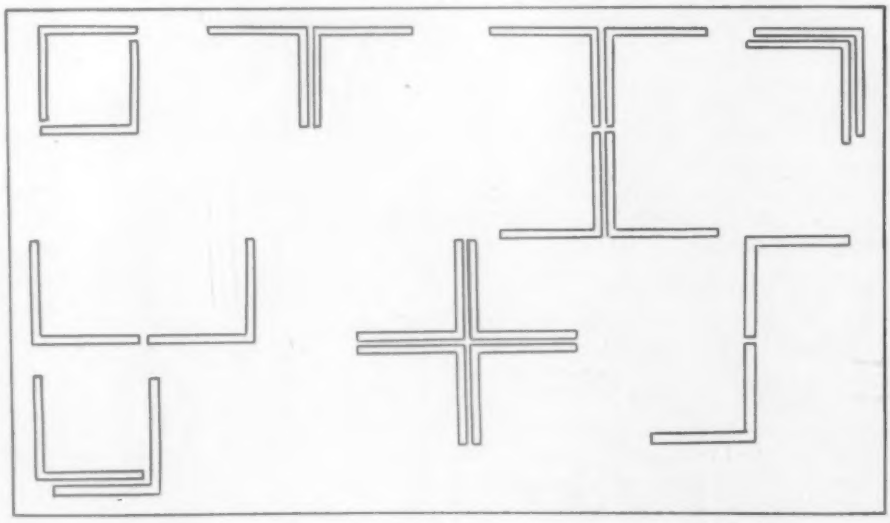
What about the future of the men in Group II? Will there be jobs available for them?

My own belief is that, when peace finally comes, those who want to weld will continue to make their livings in this way. Leading industrialists agree that welding is still going through the stages of "growing pains." New ways are being found every day in which welding can be used to advantage over former methods of joining metal or fabricating metal parts. These new applications of welding, though brought into use as a result of war, can readily be adapted for peacetime manufacturing and construction. Ships, automobiles, bridges and most steel buildings will henceforth be welded.

Women Weldors in Group I

As for women weldors, the writer believes that most of them may be classified in the first group. After the war, the glamour a woman now enjoys in being a weldor will have vanished, and it is a safe bet that she will then either return to household duties or to some other, less exacting occupation. Of course there were women weldors before the war in some places and there will undoubtedly be more after the war, but the man who intends to make welding his life work need not worry about women crowding him out of employment so long as he improves his skill and keeps up-to-date on the developments of his trade.

Fig. 5—Some of the different designs into which old steel bed rails can be worked. Two in. tack welds on 12 in. centers are made to hold the rails in place.



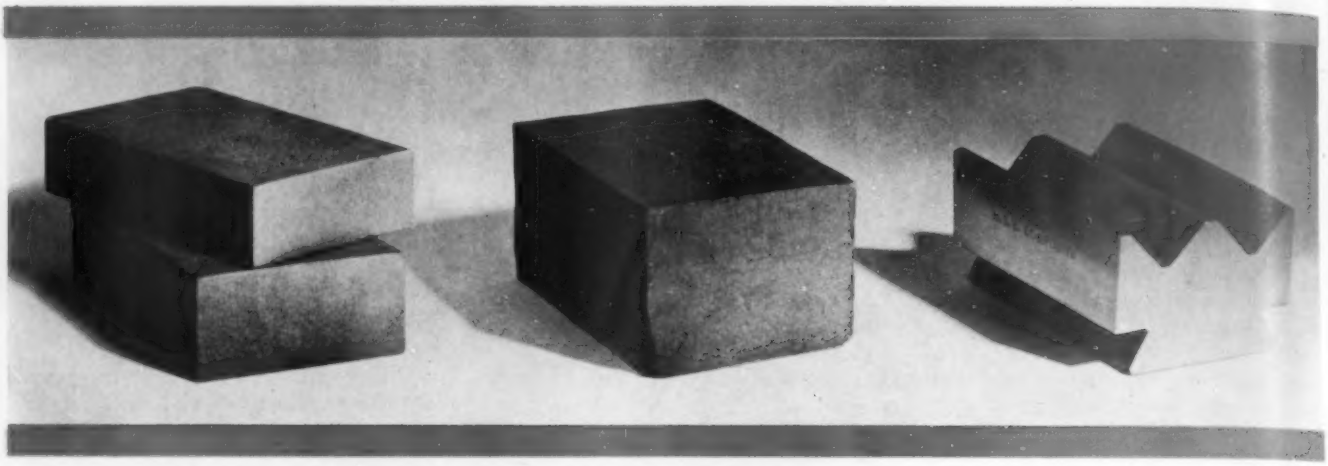


Fig. 1—On the left is a blank of high speed steel (top) and a blank of mild steel. After the faces of these blanks are ground into perfect contact, they are butt welded into one block (center). On the right is the finished tool. This tool uses less than 2% of critical tungsten, and it is hard at the cutting edges but tough at the dovetail where toughness is important.

Welded Composite Tools

Resistance welding is being utilized to make tungsten-conserving tools that combine the ductility of a medium carbon steel with the cutting qualities of high speed steel. Low tungsten-moly tips are being used.

By **A. M. GRUNER**
Vice-President, Genesee Tool Co.

ALTHOUGH hailed largely as a means of conserving strategic tungsten, the current popularity of composite steel tools has even more than that vital advantage to recommend it.

Some years prior to the war, my company experimented on composite tools consisting of high speed steel tips that were "cinch-welded" into recesses of mild steel shanks. At that time there was not much of a problem in connection with material shortages, and the development was initiated mainly to provide a tool having high hardness at the cutting edge and greater ductility at the mounting to minimize fractures.

Early Tools

Early forms of such tools were applied mainly to forming work on screw machines and similar equipment—usually requiring dovetail type mountings. The chief advantage presented was that the cutting edge could be made of high speed steel while the dovetail was of medium carbon steel and, therefore, less susceptible to fracture of the dovetail corners. In addition to the greater ductility and inherently higher strength of the dovetail shank (particularly at the corners), such tools gave the added advantage of more easily drilled and tapped holes for attaching them to the fixture.

In fabricating such composite tools, the blank and shank were machined and the latter was recessed. The actual

Table I. Hardening Data

Hardening Temperature, F	Fracture	Rockwell C as Quenched	Rockwell C after 2 hr at 1,025 F
2,150	Very fine	65.0 – 66.0	66.0
2,200	Fine	65.0 – 66.0	66.0
2,250	Fine	64.0 – 65.0	66.5
2,300	Slightly coarse	63.0 – 64.0	67.0

Oxidizing Atmosphere in Furnace

Temperature, F	Time	Rockwell C as Quenched	Rockwell C after Tempering at 1,025 F
2,200	4 to 8 min	65.0	65.0 – 66.0
2,225	4 to 8 min	65.0	65.0 – 66.5
2,250	3 to 6 min	64.6	65.5 – 67.0
2,275	2 to 4 min	64.5	66.0 – 67.5
2,300	2 to 3 min	64.0	66.0 – 67.5

cinch-weld was accomplished during the hardening operation, the process being somewhat similar in character to a braze. When the tool came out of the heat-treating furnace, the shank remained moderately hard while the tip was in the hardness range of 63-66 Rockwell C. Grinding then brought the tool to its finished form.

This process proved quite successful (after initial difficulties had been overcome), and by 1938 a considerable number of tools of this type were in regular use. Little was said about the process at the time, however, and it was not until after U. S. tungsten supplies had been pretty well cut off that the advantages of the method were suddenly "discovered." Of recent months, many such tools have been produced, employing both the 18-4-1 series (tungsten-chrome-vanadium) and molybdenum types of high speed steel tips.

Applying Butt Welding

A number of years ago development of an improved method of producing composite steel tools was initiated with the object of providing a stronger bond between the high speed steel and the soft steel shank. Eventually, it was found that a satisfactory result could be achieved through the use of resistance butt welding.

In production, blanks of mild or medium steel (usually SAE 1040) are rough cut to size from bar stock. The high speed steel blanks are forged to approximate size. The parts are annealed, and their faces are ground to insure a positive contact. The parts are then preheated prior to welding, which is done in a butt welder of special design.

The thickness of the HSS blank will depend, of course, on the depth of the "form" to be ground into the tool and on resharpening considerations, while the thickness of the shank is determined roughly by the type of and size of mounting to be used. On an average, the general proportion is about a third high speed to two thirds mild steel.

The various steps are shown in Fig. 1. At the left are the two blanks, the upper being of high speed steel. In the center is the tool blank as it appears after butt welding, while the finished tool made from such a blank is shown on the right.

Suited to Low Tungsten Steels

At the outset, numerous varieties of steel were employed for the blanks. As the use of tungsten became more and more critical, however, an increasingly greater proportion of such tools has been produced from high speed molybdenum steels containing less than 6% tungsten. These steels lend themselves well to heat treating in furnaces used formerly for high tungsten (18-4-1) steels.

The practice of butt welding medium carbon steel shanks to hard steel cutting tools is, of course, not new. At Genesee, numerous tools having a long taper shank have been produced in this manner for a considerable number of years, the purpose being, in addition to the securing of greater ductility for the long shank, to reduce the amount of scrap and production time. Naturally, less machining time is required when the tool is fabricated from two pieces.

Welding and Heat Treating

Since composite steel die-sections have been produced by welding for some time, the actual butt welding operation presented no major technical difficulties. The new electronic controls, it was found, make it possible to control the welding cycle in such a manner that the composite steel tool can take the same heat treatment as that recommended for the high speed steel of which the blank is made.

As to heat-treating equipment, experience has shown that the time required to harden the low tungsten-moly steel increases with the percentage of carbon monoxide in the furnace atmosphere. The moly high speed steels thus react much like the 18-4-1 steel.

Hardening Data

Hardening temperatures range from 2,150 to 2,300 F, the former temperature producing a very fine grain structure, and the latter a slightly coarse structure. Tools hardened at around 2,150 F range around 65.0 to 66.0 on the Rockwell C scale, as quenched, and around 66.0 after drawing at 1,025 F for two hours.

When the steel is hardened at the higher temperature, its Rockwell C hardness is about two points less, but the hardness may be increased to around 67.0 after drawing for two hours at 1,025 F.

Tables I and II give characteristic hardening and drawing data for low tungsten-molybdenum steel. Table I is self-explanatory. Table II shows two typical tempering series: one based on hardening in the lower range, namely 2,225 F, and the other on the higher range of 2,275 F. One inch round hot rolled bars were turned to ⅞ in. diam for the cutting of specimens 3 in. long. The preheat temperature was 1,500 F (for 20 minutes), and the samples were hardened in a muffle type furnace having an atmosphere of 11% CO. All pieces were oil quenched. The time at 2,225 F was 5½ min, and at 2,275 F, 5 min. Fine-grained fractures showed at both temperatures. The tempering time was 2 hr.

Hardnesses of 18-4-1 Steel

By way of comparison, Table III gives hardening data for an 18-4-1 steel. Test pieces 1 in. square were machined on two flat surfaces to remove decarbonization and cut to 3 in. lengths. These were then hardened by (1) preheating at 1,600 to 1,650 F, (2) bringing up the temperature to the series listed and (3) quenching in oil. The resulting hardnesses are not quite so high as those shown in Table I.

Table II. Drawing Data

Drawing Temp, F	2,225 F Series (Rockwell C)	2,275 F Series (Rockwell C)
0	64.0 – 65.5	63.5 – 65.0
400	62.5 – 63.5	62.5 – 63.5
500	62.0 – 63.0	62.0 – 63.0
600	61.0 – 62.0	60.5 – 61.5
700	60.5 – 61.5	60.5 – 61.5
800	61.0 – 62.0	61.0 – 62.0
900	63.5 – 64.5	63.5 – 64.5
1,000	65.0 – 66.5	66.0 – 67.0
1,025	65.0 – 66.5	66.0 – 67.5
1,050	64.0 – 65.5	65.0 – 66.5
1,075	63.5 – 64.5	64.5 – 65.5
1,100	63.0 – 64.0	63.5 – 65.0
1,150	61.0 – 62.0	61.0 – 62.5
1,200	57.0 – 58.0	57.0 – 58.0
1,300	46.0 – 47.0	46.0 – 48.0
1,400	36.0 – 37.0	37.0 – 39.0
1,500	31.0 – 33.0	31.0 – 33.0

Table III. Hardening Data for 18-4-1 Steel

Temperature, F	Rockwell C	Brinell	Shore	Fracture
1,800	53 – 54	512	73 – 75	Slightly coarse
1,900	57 – 58	555	77 – 79	Slightly coarse
2,000	58 – 60	600	81 – 82	Slightly coarse
2,100	61 – 62	640	82 – 83	Slightly coarse
2,200	63 – 64	652	84 – 85	Fairly refined
2,250	64 – 65	683	85 – 86	Refined
2,300	65 – 66	713	85 – 86	Refined
2,350	65 – 66	713	85 – 86	Refined
2,400	65 – 66	713	85 – 86	Slightly coarse

Atomic-Hydrogen Welding

Fig. 1—The arc stream or "fan" follows a horseshoe-shaped path between the two tungsten electrodes and is enclosed in a hydrogen flame.

Both manual and automatic applications of atomic-hydrogen welding are discussed in this authoritative account of the new process. Multiple-arc welders have been designed and are now spurring on the war effort by making longitudinal seam welds for truck rear axle housings.

By L. G. PICKHAVER
Welding Engineer, General Electric Co., Chicago.

One of the more recent developments in welding is the increased use of the atomic-hydrogen process, wherein an A-C arc is maintained between two tungsten electrodes in an atmosphere of hydrogen. Both manual and automatic welding methods may be used.

Manual Welding

The simplest equipment is that used for manual welding. It consists of: a power control unit, electrode holder, stop-start buttons, a source of hydrogen, and the necessary cable and hose for conducting current and hydrogen.

The power control unit is a high reactance, moveable-coil transformer with an open-circuit voltage that permits easy starting and arc maintenance. The arc voltage in this process is higher than in metal arc welding, running as high as 90 or 100 volts. The greater the distance between coils, the greater leakage flux and hence the lower output. Conversely, when the coils are close together the leakage flux is small and the output high. In this design, the primary coil is moved with respect to the secondary coil by means of a screw connected to the handwheel. There is an infinite number of coil positions, making available a continuous current range from minimum to maximum output. Capacitors mounted in the transformer case improve the power factor by reducing the primary current demand by one third, thus allowing the use of smaller primary line switches, fuses, etc. Contactors and a solenoid valve are provided to control the power and the flow of hydrogen to the electrode holder.

Electrode Holder Design

The electrode holder is the means by which the arc is maintained in the hydrogen atmosphere so that the available energy can be applied to the welding problem. The holder consists of two tubular current-carrying members which conduct both the hydrogen and the current. Insulated handles are molded over the end of the tubes through which connections are made to the gas and electrical supply. On the other end of each tube is mounted a clamp for holding a tungsten electrode and for providing a jet of hydrogen which completely surrounds the electrode. The clamps are so arranged that the electrodes converge at an angle of about 30 deg, their arcing ends meeting in the confluent stream of hydrogen. One of the tubes contains a flexible loop that is connected to a trigger on the handle. Slight pressure on the trigger separates the electrodes; releasing the pressure permits the electrodes to come together. The trigger thereby allows the operator to establish and maintain the desired arc length.

Heat Transferred by Hydrogen

Unlike other methods of arc welding, the arc does not generate heat in the work. Instead, heat generated in the arc is transferred to the work by the hydrogen. As the gas passes

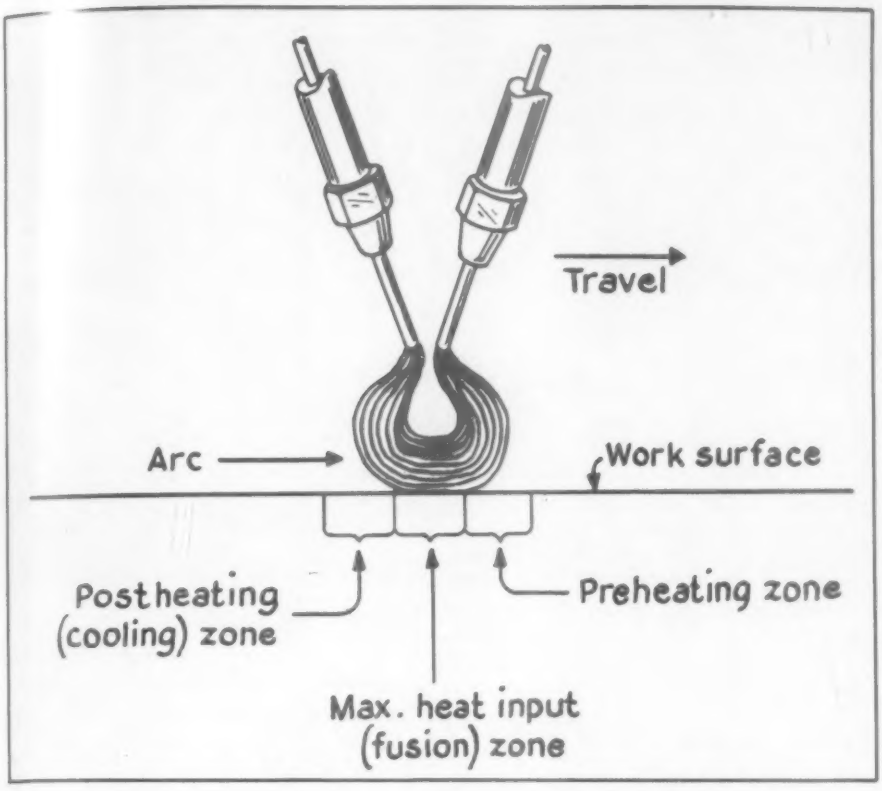


Fig. 2—Schematic diagram of atomic-hydrogen welding. Note the preheating and postheating effects in advance of and behind the weld zone.

through the arc from the jets or orifices around the tungsten electrodes, the molecules of hydrogen separate into their component parts—atoms—thus giving the process its name of "atomic hydrogen." As the gas in the atomic state is being displaced with molecular hydrogen under a slight pressure, it is urged out of the intense heat of the arc and recombines, giving up its heat of dissociation. It is the latter heat that produces the resultant welding temperature. The outer edge of the arc stream is the zone of recombination of the atomic gases.

The Arc Fan

The arc stream or "fan" as it is commonly known, Fig. 1, follows a path similar to a horseshoe suspended by its legs from the electrodes, expanding and contracting as the arc is lengthened and shortened. Ordinarily, a ⅜ in. to ¾ in. fan or a 50 to 90 volt arc, producing a singing noise, is used. A short arc, ranging from 20 to 40 volts (often termed a "silent arc"), is occasionally used to obtain a point source of heat. A long, narrow heat source is produced by means of the proper arc length. When the fan is carried vertically and approximately parallel to the line of weld, the heat will be applied over an elongated area with length approximately four times the width. Such a heat source will produce a very narrow weld.

The semicircular shape of the arc fan is a fortunate characteristic since it results in graduated heat input to the work beneath the different portions of the arc. This is diagrammed in Fig. 2. The preheating effect at the leading edge of the arc contributes to the rapid travel speed obtainable with this process. The postheating at the trailing edge reduces quenching and slows the solidification of the weld metal, thus permitting entrapped gas to escape. In addition, the excess hydrogen produces a shield around the arc and weld metal, giving unusual freedom from oxidation.

Atomic-hydrogen welds are unusually ductile, homogeneous and smooth because the arc causes no turbulence. Since the area surrounding the weld is free from spatter and scale, Fig. 3, grinding and finishing are greatly reduced. For these reasons, the atomic-hydrogen process readily lends itself to the welding of longitudinal seams.

The process is applicable to practically all ferrous and non-ferrous alloys, including the so-called "hard-to-weld" metals. It is used extensively in the repair or building-up of dies and molds, for which it offers the decided advantage that carbon "burn-out" can be controlled. For example, if a filler rod of the same chemical analysis as the work but containing approximately 30% more carbon is used, the weld deposit will have exactly the same properties as the remainder of the work. It will respond to the same heat treatment and have the same wearing qualities. If desirable, a filler metal can be used that is more resistant to wear than the parent metal.

Automatic Welding

Automatic (machine) atomic-hy-

Fig. 3—The finished atomic-hydrogen weld is smooth, uniform, and free from slag and spatter as illustrated by this view from "The Inside of Atomic-Hydrogen Arc Welding."

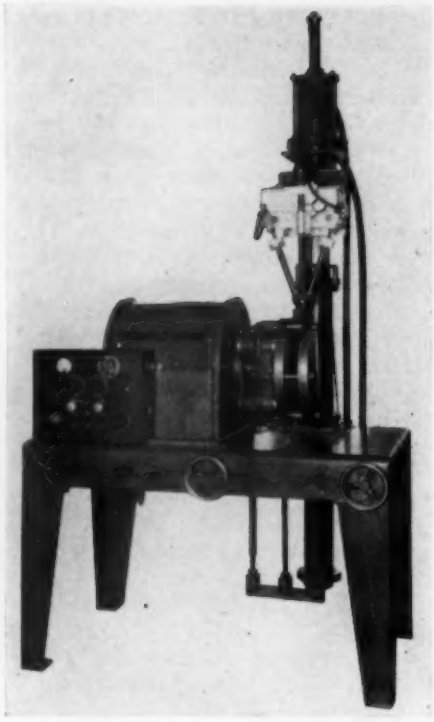


Fig. 4—Automatic atomic-hydrogen welder designed for welding seams on a curved piece.

drogen arc welding has been found desirable in the production welding of tubing and other products fabricated from non-ferrous or ferrous metals by means of circumferential and longitudinal seams. The automatic head is a device in which the electrodes are clamped in carriers that are connected to a motor through a gear reduction. The motor is controlled electronically by a series of vacuum tubes that amplify any change in arc voltage on the motor armature, causing it instantly to feed or withdraw the electrodes and correct the arc length. By eliminating the time lag caused by contactors and other moving parts, the impulse to the driving mechanism is almost simultaneous with the arc changes. A more uniform arc and, consequently, a more uniform weld results.

Fig. 4 shows a typical automatic atomic-hydrogen machine welder with its automatic head and operator's station. This machine welds both the inside and outside radii of a curved work piece.

Small alloy tubing may be readily welded by automatic atomic-hydrogen. In a typical application, the tubing is less than ⅜ in. ID and has a wall thickness of approximately 0.035 in. Complete penetration is obtained without the use of the customary chill bar such as is frequently used in metal arc welding. The amount of upset or bead may be controlled by increasing or decreasing the side pressure on the tubing at the point of welding.

Slow Cooling with Hydrogen

The forgoing paragraph brings up another of the desirable characteristics of atomic-hydrogen welding; *i.e.*, the use of hydrogen gas as a backing. A metallic backing or chill bar oftentimes causes cracks, porosity and other defects because of the rapid rate of cooling of the molten metal in the weld zone. The chilling effect of hydrogen is much less severe than that of metallic backing for chill bars; thus undesirable porosity and cracks which may result from drastic quenching are usually eliminated. In addition, the hydrogen prevents oxidation on the underside of the weld.

Even when 100% penetration is obtained, it was found on 3/16 in. material, the surface tension of the steel is alone sufficient to support the molten pool when using only a backing of hydrogen.

Multiple-Arc Welders

As the maximum welding current which can be satisfactorily used in a single arc is 150 amp, the only way to increase production on heavy plates is to use more than one arc—either as separate units or combined into a single multiple-arc unit.

Two multiple-arc units having ten arcs each are installed at the Clark Equipment Co., Buchanan, Mich., and are used to fabricate tubing from plate stock in the manufacture of one-piece rear axle housings for trucks. Through the courtesy of this company, we are permitted to show (Fig. 5) the ten successive stages necessary to turn a piece of plate stock into a finished housing. The first three stages shown in Fig. 5 are, left to right:

1. A flat plate approximately 17 by 66 by 5/16 in.

2. The rolled tube with an open seam. The edges of the plate are beveled and conditioned as they pass through the milling roll.

3. The welded tube after it has passed through the welding unit (Fig. 6), which closes the tube and causes it to travel along the line of the arc.

High Quality Welds Needed

The remaining seven steps are important to this story merely because they indicate the quality of welds required. Note how the tube increases in length when the ends are swaged to

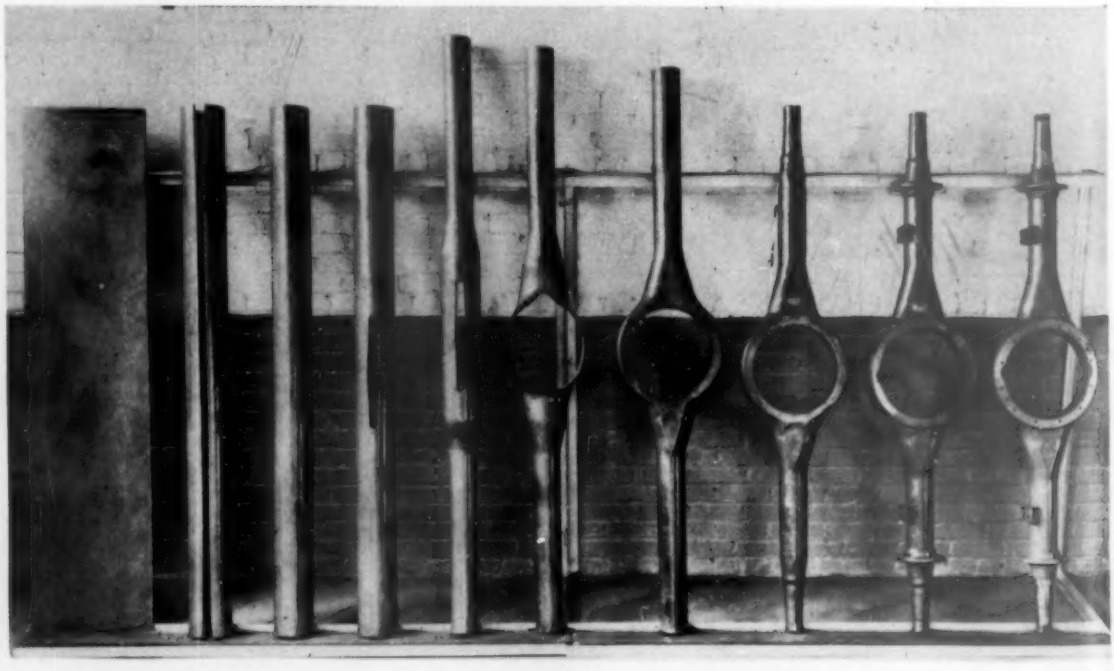


Fig. 5—Ten stages in the manufacture of automotive rear axle housings at the Clark Equipment Co. Automatic atomic-hydrogen welding occurs at Stage 3 (from left).

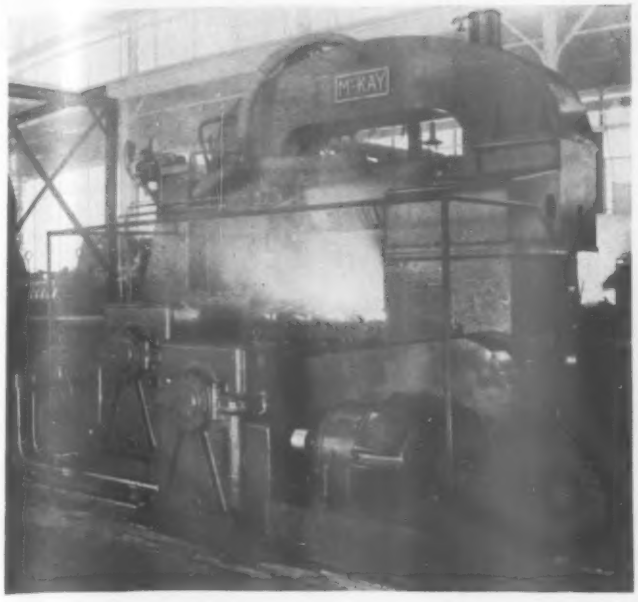


Fig. 6—Multiple-arc atomic-hydrogen equipment for welding tubes at the Clark Equipment plant.

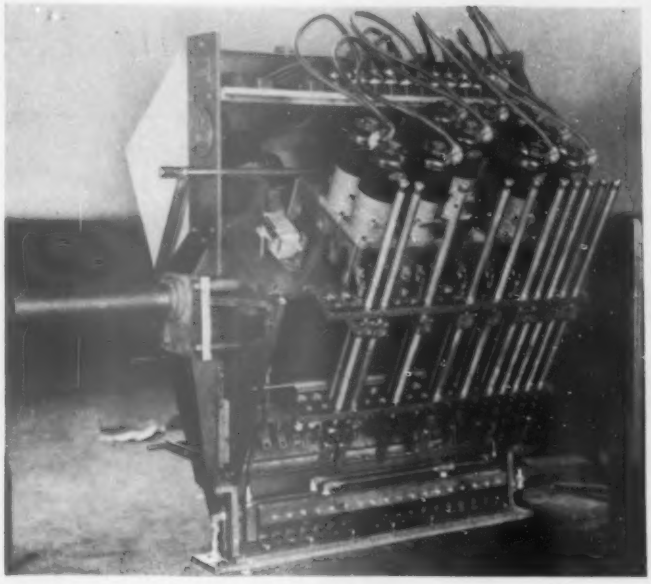


Fig. 7—Oblique side view of automatic welding head. Two motors, electronically controlled, govern the feeding of each pair of electrodes.

a smaller diameter. The wall thickness of the swaged ends also increases. The weld is to the left of the slot which is expanded to form the circular head of the "banjo." When the banjo is formed, the wall thickness of that portion of the tube decreases considerably. Obviously, the weld must possess very high physical properties in order to grow in thickness and length in one portion of the housing while increasing in length and decreasing in thickness in another part.

A detailed view of the multiple-arc head used at the Clark Equipment plant is given in Fig. 7. There is a motor for each electrode—two motors for each arc. The electronic control for each pair of motors is so arranged that the operator may feed or withdraw any electrode to compensate for occasional differences in the melting rate of the tungsten.

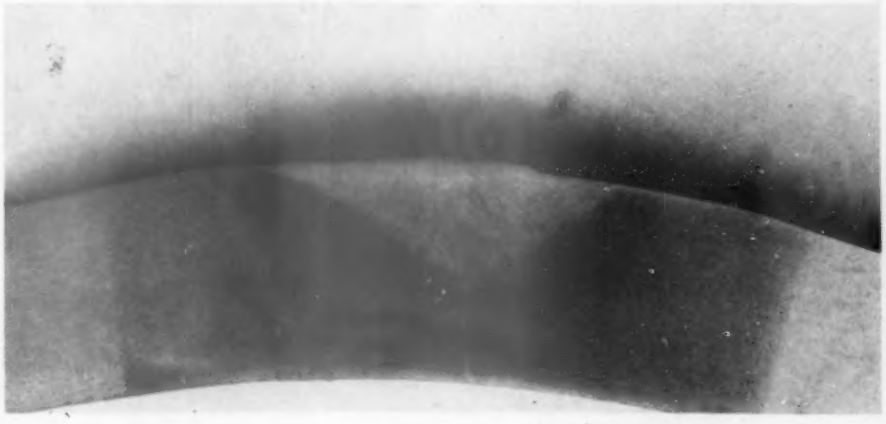
The odd spacing of arcs in the above is the result of theory proved by experience. During the heating of the tube prior to the time of fusing, the leading arcs should be grouped as closely as possible in order to provide a continuous heating zone of high intensity. The remaining arcs are spaced as determined by their functions of holding the molten pool at the desired temperature until the weld has been finished and preventing too rapid an air quench.

The edges of the blanks are beveled for single vee grooves as they pass through the milling roll. When the tube is formed, the included angle of the vee will be approximately 90 deg and root face about 3/32 in. Side pressure is applied as the tube passes under the welding head to close the seam and butt the root faces of the joint. As the closed joint passes under the closely spaced leading arcs, molten metal (which will not cling to the sloping sides of the vee) begins to form at the bottom of the groove. Simultaneously, or very shortly thereafter, the root faces of the joint become plastic and additional side pressure tends to close the vee and raise the bottom of the groove, thus decreasing the volume necessary to fill it. When the groove has been filled, the molten metal is maintained at a temperature slightly above that necessary to keep it liquid and the unfused metal below the molten pool is raised to a forging temperature by conduction. At this point, additional deformation of the plastic metal by pressure rolls produces a forge weld at the bottom of the joint. The forging action also increases the wall thickness at the point of welding.

As the tube passes on through the propelling unit, the arcs are so spaced that the solidification of the molten metal must progress from the bottom upward, thus allowing any trapped gases to escape through the molten top surface. By the time the tube has reached the outlet roll, the weld has cooled sufficiently below forging temperature so that it possesses enough strength to prevent cracking. At this stage, the bead or increased wall section may be rolled to a thickness approximately equalling the remainder of the tube. Thus the finished tube has, for all practical purposes, a uniform wall thickness—often difficult to distinguish from seamless tubing.

The weld, as shown in the macrograph of Fig. 8, consists of two distinct parts. The upper section, extending to about one-half the plate thickness, is the usual cast structure, showing the effect of hot rolling. The lower portion is a forged weld and is much the same as a forged weld made by a blacksmith.

Fig. 8—Macrograph of atomic-hydrogen weld made on 21/64 in. material with multiple-arc equipment. The upper section shows the effects of hot rolling and the lower section is a forged weld.



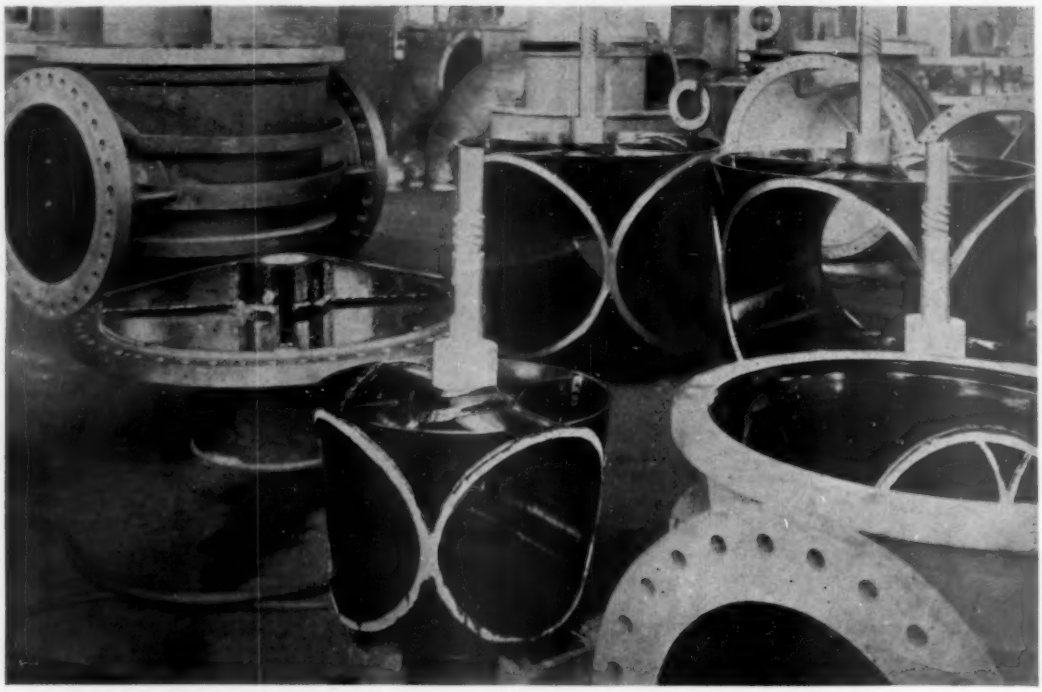


Fig. 1—A shop view of three 36 in. and one 20 in. welded steel valve plugs. Note the seat rings of welded Monel metal deposited directly on the steel plate.

Large Welded Valves

Welded plug valves of prewar design are important parts of many municipal water systems. Difficulties overcome in fabricating these complicated pieces may suggest a solution to war contract problems.

By **T. B. JEFFERSON**

War demands on foundry capacity have wrought many changes in industrial fabrication methods. As a result of industry's desire to obtain finished products more quickly, weldments have supplemented castings in some instances, while, in other cases, weldments have replaced castings.

The combining of welding with castings or the replacing of castings by welded fabrication is not new. It was being done for years before the war but not always to the complicated extent that is seen in present day products. Military demands have made this use a common occurrence; however, it is also practiced in fields once confined exclusively to castings.

A notable example of this new trend is seen in the substitution of valves of welded fabrication* for forge and cast steel valves for use in marine work. Much of the popularity of small welded valves may be attributed to large welded valves which, although complicated, were a prewar product.

Large Welded Valves

Large valves fabricated from plates and shapes by welding have in recent years become an important part of the water supply systems of many municipalities. Many of these large valves were furnished by S. Morgan Smith Co., York, Pa., which has pioneered the manufacture of large welded valves under the trade name "Rotovalve."

*See "Welded Globe Valves," The Welding Engineer, October, 1942, pages 43-45.

Making Large Valves

Rotovalves are essentially large plug valves which are operated by rotation of a plug within the valve body. In this respect they differ from the small welded valves, which are usually of a globe or gate type. In either of the last two types, the valve disc is raised or lowered, as the case may be, to open or close the valve.

The fabrication of large valves presents many problems, particularly those due to size. Valves of this type may weigh 15 tons or more and are used on pipe lines up to 60 in. diam; valves of the latter size have been built for the City of Denver, Colo.

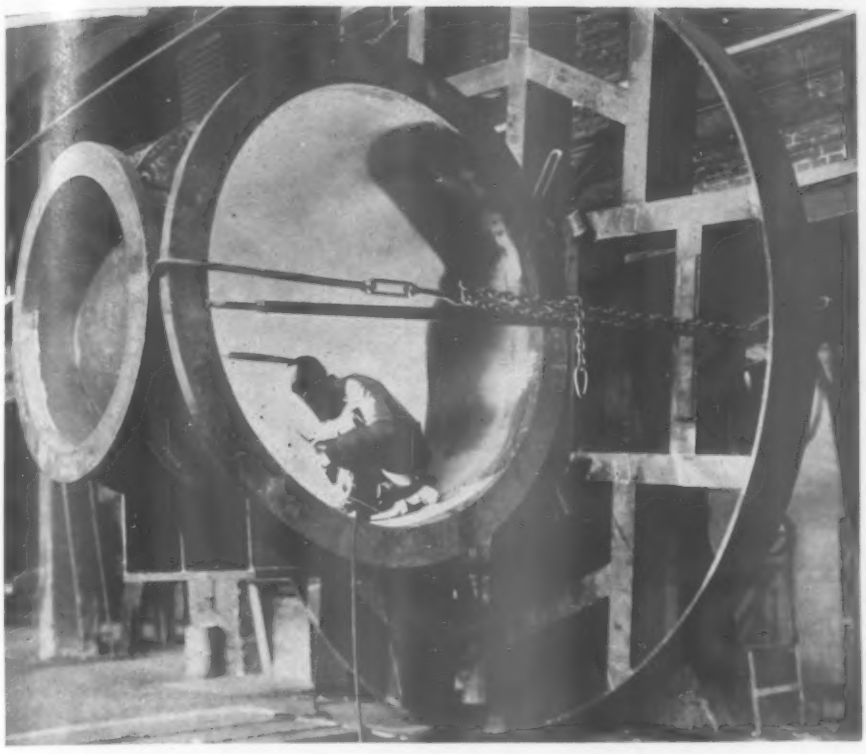


Fig.2—This positioner is capable of handling valves much larger than this 48 in. welded valve for the City of Milwaukee.

To fabricate such large valves, the steel plates are rolled into a conical shape to form the valve bodies and into cylinders for the inlet and outlet pieces in the waterway.

Plates used in the construction of these valves range in thickness from ⅜ to 1½ in. The thinner plate, of course, is used in the construction of the valve head, *i.e.*, the barrel section which houses the operating mechanism. The heavier plates are used in the body and the plug. On these parts the thickness of the plate depends upon the size of the valve; however, the smallest welded valve uses 1¼ in. plate. A valve of this size and plate thickness is designed for a working pressure of 375 psi. The base of the valve body consists of a flanged and dished head.

After the pieces have been formed, they are prepared for welding in accordance with paragraph U.72, Section VIII of the ASME boiler construction code for unfired pressure vessels. The first step is to weld in place the reinforcing ribs and the inlet and outlet necks. After the body has been welded completely, the outlet opening is flame-cut, this operation being held to the last so that the stiffness of the conical shell will aid in keeping the body in alignment.

Monel metal is now deposited 3/16 in. thick in a ring 1¼ to 2 in. wide around the interior of the pipe line openings in the valve body, Fig. 1. This deposit is subsequently machined and becomes the body seat.

Cast Parts, Too

The design of the Rotovalve is such as to take advantage of the best suited materials. Consequently, the valve is of composite design. In the body, cast steel is used for the bearing housing and for the various flanges, *i.e.*, the top flange and the inlet and outlet flanges for pipe line connections. The trunnion bearings of the plug are also cast steel.

The Plug

The plugs of these large valves are also rolled from steel plate. The plug has a conical shape which conforms closely to that of the body except that it is, of course, slightly smaller in conical diameter. The welding procedure for the plug is quite similar to that used on the valve body.

Since the plug must seal off the water, to prevent leaks when closed as well as to prevent leakage in the valve when open, it is fitted with four seat rings. These rings, like those of the body, are arc welded pads of

Fig. 3 (left)—A positioner to make the depositing of Monel metal for a body seat ring a comparatively easy task.

Fig. 4 (below)—Cleaning the edges of the Monel seat of a 60 in. valve plug. Note the stiffeners welded between the waterway and the conical side.

Fig. 5—Owing to the two flexible metal hose exhausters shown here, the welders work in an atmosphere comparatively free of smoke and fumes.

Monel metal so deposited as to permit the weld metal seat rings of the plug to match those of the body in either opened or closed positions.

Positioners Speed Work

Positioners are used to a decided advantage on this job. By mounting the parts of these valves on large positioners, it is possible to place them so that all of the welding may be done in the downhand position, Fig. 2. Accurate positioning greatly facilitates the construction of these valves and eases the problems which are usually encountered in handling objects of their size and weight. When the many multiple-pass circumferential seam welds to be made are considered, it will be found that the use of positioners greatly speeds production, too. Positioning is also used advantageously during the deposition of the Monel metal facing for the plug and body seat rings, Fig. 3.

Other Working Aids

Flame-cutting plays an important part in the shaping of the many gussets and reinforcing ribs which go to make the finished product. In addition to the circumferential reinforcing rib of the body, there are many flame-cut stiffeners (see Fig. 4) welded between the waterway and the conical shaped side of the plug. An air-driven chipping hammer is another tool used extensively on this job. As a chipping tool, it is employed in cleaning up welds, particularly along the edges of the welded Monel seats. At other times the chipping hammer is fitted with a peening tool for use in cleaning weld beads of slag and for peening the welds.

Since some of the larger valve bodies are of such a size as to permit the weldors to work in them at one time, a problem of ventilation could arise—primarily because of the huge quantities of smoke given off in a confined space. These possibilities are avoided, however, by the use of fume exhausters. In Fig. 5, it will be noted that the welding fumes are collected and carried away by a flexible metal hose placed near the welding arc.

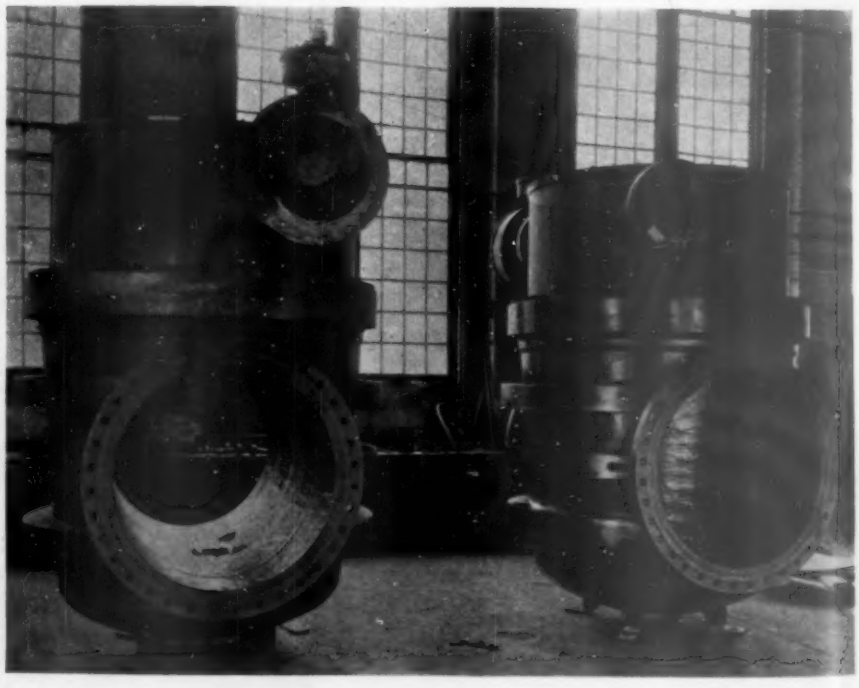
Operating Mechanism

After welding, all parts are stress relieved prior to machining. When the machining operations have been completed, the valve is assembled. The assembly consists primarily of placing the plug in the valve body and installing the worm gear operating mechanism for opening and closing the valve. The operating mechanism, which is attached to a manual or motor drive, is enclosed in a housing of welded steel construction. Rolled plates form the cylindrical barrel, the head, flanges and reinforcement ribs of this housing.

A view of two completed valves, one open, the other closed, is shown in Fig. 6. These are two of a number of 42 in. manually operated valves which were fabricated for the Los Angeles Bureau of Water Works and Supply for use on the 18 mile pipe line from Stone Canyon Reservoir.

The flow of water in the Stone Canyon outlet line is controlled by some thirty valves, most of them Rotovalves, which range in size from 20 to 42 in. The majority of these valves are manually operated and are designed for a working pressure of 175 psi. Five valves may be used with pressures up to 225 psi.

Fig. 6—Two 42 in. manually operated valves of welded steel construction for the Los Angeles Bureau of Water Works and Supply. These valves weigh approximately 25,000 lb each.



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On the Job

Torch Cleaning Method

AN INGENIOUS cabinet for the pressure cleaning of welding and flame-cutting torches with carbon tetrachloride was the suggestion of George L. Cain, machinist of the Shipbuilding Div. of the Consolidated Steel Corp., Ltd., Orange, Tex., to the War Production Drive. This invention is applicable in all shipyards and is said to clean oxy-acetylene torches with a minimum of time, labor and materials.

George L. Cain, machinist of Orange, Tex., invented this torch cleaning cabinet as his contribution to the war effort. An air pressure of 50 psi forces carbon tetrachloride through the oxygen and acetylene hoses and into the torch.

In this method, the oxygen and acetylene hoses of the torch are connected by means of ¼ in. piping to a system of seven valves and a pressure regulator. An air hose is connected to the proper coupling, and the carbon tetrachloride tank is charged with one gallon of this liquid. All valves in the circuit are closed while the valve in the air supply line is opened. The air passes through a pressure regulator and into the carbon tetrachloride tank. After a pressure of approximately 50 psi has been built up in the tank, the air is cut off at the pressure regulator.

Two valves are now opened, allowing the carbon tetrachloride to flow through both the oxygen and acetylene hoses into the torch, from which it passes down a recovery tube and into a recovery tank. These valves are now closed.

The pressure regulator and two other valves are next opened for the purpose of allowing air to flow through both hoses. After hoses and torch have been dried by compressed air, the air pressure remaining in the carbon tetrachloride tank is released and a drain valve in the recovery tank is opened, allowing the carbon tetrachloride there to drain back to the original carbon tetrachloride tank.

» «

U-Boat's Foe

THE FIRST submarine patrol vessel ever built in Chicago and the first all-welded vessel to be built by Pullman-Standard hit the water on May 2. This ship and its sister patrol boats soon to follow have been termed "shepherd dogs of the sea" by Navy spokesmen.

Speaking at the launching ceremony, Commander Eugene E. Paro, hero of the submarine evacuation of Army and Navy nurses and other personnel from Corregidor, told the shipyard workers how the new patrol vessel would be used for unlimited ocean service against enemy submarines. "This ship will be so armed that no submarine will be a match for her on the surface," he said. "Its very presence on the ocean will make the enemy dive during daylight hours. Even when submerged, however, the presence of the submarine will be known to the people of this ship, and vital convoys will then be routed away."

The new naval patrol vessel is the eleventh major item of armament being manufactured by the Pullman-Standard Car Manufacturing Co., which is also producing tanks, howitzer carriages, trench mortars, bombs, large caliber shells, parts for anti-aircraft gun mounts, wings for Douglas cargo planes and freight cars for war service.

America's answer to the threat of Axis submarines! This all-welded submarine patrol vessel and its sisters under construction are expected to effect drastic reductions in the losses of supplies and armaments caused by convoy sinkings. A second sub patrol ship was launched on May 15—less than two weeks after this one was launched.

» «

Ignitrons Seam Welded

IGNITRON tubes play a vital role in the electronic control of resistance welding, but resistance welding likewise plays an important part in the production of ignitron tubes. The accompanying picture shows an operator at the Westinghouse Lamp Division, Bloomfield, N. J., seam welding the metal jacket in which the tube mechanism is enclosed. These big tubes are going to be used to convert A-C into D-C in order to make aluminum for American fighting planes.

The "ammunition" being turned out by this worker is not bombs but ignitron tubes to supply rectified power for aluminum production. The metal jacket is seam welded—an operation no doubt controlled electronically by other ignitron tubes which are not visible in the picture.

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LOUISIANA—Woodward, Wight & Co., NEW ORLEANS
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MARYLAND—Southern Oxygen Co., HYATTSVILLE and BALTIMORE
MASSACHUSETTS—Brown-Wales Co., BOSTON
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MISSOURI—Puritan Compressed Gas Corp., KANSAS CITY
MISSOURI—Ross-Frazer Iron Co., ST. JOSEPH
OHIO—Universal Power Co., CLEVELAND
OKLAHOMA—Big Three Welding Equipment Co., TULSA and OKLAHOMA CITY
OREGON—Industrial Air Products Corp., PORTLAND
PENNSYLVANIA—Arcway Equipment Co., PHILADELPHIA and PITTSBURGH
PENNSYLVANIA—Shop Supply Co., PITTSBURGH
TENNESSEE—J. E. Dilworth Co., MEMPHIS
TENNESSEE—Southern Oxygen Co., KINGSPORT
TEXAS—Big Three Welding Equipment Co., FORT WORTH. HOUSTON, EL PASO, SAN ANTONIO and AMARILLO
TEXAS—Corpus Christi Oxygen Co., CORPUS CHRISTI and McALLEN
VIRGINIA—Southern Oxygen Co., RICHMOND
WASHINGTON, D. C.—Southern Oxygen Co.

Resisto-Loy COMPANY GRAND RAPIDS, MICHIGAN

Welded Fintubes

BECAUSE the fuel oil compartments of the Liberty Ships now under construction for the Maritime Commission are in a comparatively cold location, it is necessary to provide a means of heating the fuel. Hence two fuel oil heaters are installed in the engine and boiler room of each ship for the double purpose of making the fuel flow more freely and of improving its combustion rate. Each of these heaters has the capacity to heat 35,000 lb per hr of bunker C fuel oil from 100 to 230 F when supplied with steam at 125 psi pressure.

Courtesy, Brown Fintube Co.

Formed steel channels are resistance welded to the walls of plain tubes to produce fintubes. Since one fintube can deliver a heat transfer service that would require several bare tubes of the same length, a considerable saving in steel tonnage results.

The design of the above heaters makes use of fintubes—that is steel tubes to which longitudinal U-shaped channels have been welded. The fins provide a very large increase in exterior surface for the flow of heat from the hot steam to the cold oil.

In making this heat transfer tubing, rolled strip is first welded to produce a round tube and, second, the formed channels are welded to the tube wall. The fact that the fin is continuously welded to the main tube, providing a solid bond between it and the tube wall, assures a continuous and efficient heat transfer. The heat transfer capacity per lineal foot of the fintube is so high on account of the increased surface that one fintube is able to deliver a heat transfer service that would require several bare tubes of the same length. Moreover, by changing the number and depth of the fins, it is possible to proportion the primary and secondary surfaces to the heat transfer coefficient of the material being heated or cooled and thereby compensate for a deficiency in the heat transfer rate of one or the other of the materials.

The resistance welding methods used in the manufacture of these fintubes result in what is literally a one piece tube, permitting the heat to flow freely between the central member and the fins. Because of their heat transfer efficiency, heaters of this design save thousands of feet of steel tubing—for which there is a heavy demand in the War Production Program.

CHANGE FOR THE BETTER TO AC WITH THE WILSON "BUMBLE BEE" WELDER

If you want more production of high quality welds, change *now* to the Wilson "Bumble Bee." With this new AC welder you not only gain faster welding through the use of higher currents and larger electrodes, but you also reduce power consumption 35 to 40%!

These timely advantages of the "Bumble Bee" are provided without any sacrifice of weld quality. Even at the increased travel speeds with AC, sounder welds can be made on flat or horizontal fillet joints and in deep grooves and corner welds. "Arc blow," ordinarily troublesome with DC, is almost completely eliminated in AC welding.

The "Bumble Bee" is made in 300 and 500 ampere sizes and can be supplied with running gear for increased portability at small additional cost. For complete information write to Wilson Welder & Metals Co., Inc., 60 E. 42d St., New York.

FOR TOP-FLIGHT AC WELDING USE WILSON 530 ELECTRODE

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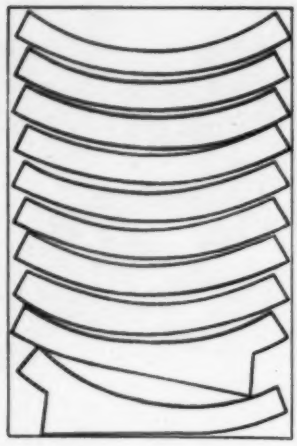
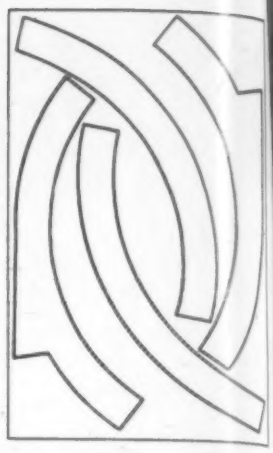
WILSON AC WELDERS — *distributed exclusively through Air Reduction Sales Co.*

Segment Cutting

AN EFFICIENT method for conserving steel plate stock by increasing the number of segments cut from it was recently suggested to the General Electric Co. by Weldor Spencer K. Fredericks, who received $750 for his idea.

Fredericks' method involved a change in arc length and a rearrangement of the templates for segments cut from large rectangular sections of 1 in. and 1½ in. plate. The amount of scrap left after cutting was greatly reduced by arranging the templates to rest crosswise as shown in the left sketch instead of lengthwise as was done formerly. The new nesting arrangement has the additional advantage that sections of uniform shape are so placed that a battery of flame-cutting torches can cut them simultaneously. Formerly, each segment had to be cut singly.





New and old methods for cutting segments for electric motor frames. Note the saving in scrap which results when the templates are arranged as per the left sketch instead of in the former wasteful way shown at right.

These segments are welded together to form large motor frames. On a job requiring the cutting of segments for 72 motors, 20% scrap saving was effected.

» «

Spot Welding Thermostats

ONLY through spot welding could the thousands of thermostats wanted by Uncle Sam for "airplane fire patrol" be rushed through the production lines on schedule at the Mansfield plant of the Westinghouse Electric & Mfg. Co.

Thousands of thermostats the size of half dollars are being spot welded for airplane "fire patrol" at the Westinghouse Mansfield plant.

These thermostats operate on much the same principle as the automatic sprinkler systems found in factories and office buildings. Carbon dioxide is used to smother the fire, which may have been caused by a tracer bullet, a leaking gas tank or an overheated motor. As soon as the fire starts, the high temperature results in unequal expansion of the two components of a bi-metallic disk, bending the disk slightly so that it touches two tiny silver contacts. This closes an electrical circuit and causes a light to flash on the pilot's dashboard to tell him which lever to pull in order to release the extinguishing gas.

In the picture, the young lady is shown spot welding the base of a thermostat to the body. Note the safety glass shield.

NO ABSENTEEISM

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REGISTERED U.S. PAT. OFFICE
A.C. ARC WELDERS

Absence of vital workers . . . or failure of important production equipment are perplexing problems of wartime industry. Both add up to the same thing—NO PRODUCTION!

But you can bank on Marquette A. C. Arc Welders not going AWOL when they are needed most. Extra sturdy construction—all asbestos insulation—no dials or nuisance gadgets to get out of order—no moving parts to wear out are some of the features built into these rugged machines that assure long continuous service and superb welding performance for all types of metal fabrication and repair.

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10 DAY DELIVERY on five outstanding models, 150 to 400 ampere capacity. LOW INITIAL COST—LOW UPKEEP—LOW OPERATING COST—INSTANTANEOUS HEAT SELECTION—AUTOMATIC VOLTAGE CONTROL—NO "MAGNETIC BLOW"—LOW IDLING COST—FAST, SIMPLE OPERATION—COMPLETELY EQUIPPED.

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A.C. ARC WELDERS

of Course **PAGE**

MAKES ELECTRODES FOR WELDING ARMOR

PHOTO BY OFFICE OF WAR INFORMATION

When it was just beginning to be understood that adopting a welded construction could multiply America's tank output, **PAGE** developed its own electrode for welding Armor—just as **PAGE** also developed its range of electrodes for welding Stainless Steel, when little Stainless was being welded.

Only one electrode is necessary to weld Armor. But **PAGE**—in conjunction with America's largest producer of Stainless Steel—developed such a wide range of **PAGE** Allegheny **ELECTRODES** that from it the welder can choose the electrode that will deposit metal in the weld that equals whatever Stainless Steel he may be welding.

As you use electrodes in these days of scarcity, we continue to caution that these should be used carefully. Use electrodes of correct analysis and of most economical diameter. Encourage welders to deposit no extra metal in the weld and to use their electrodes right to the holder.

PAGE

WELDING ELECTRODES

PAGE STEEL AND WIRE DIVISION

Monessen, Pa., Atlanta, Chicago, New York, Pittsburgh, San Francisco, Portland

AMERICAN CHAIN & CABLE COMPANY, Inc.

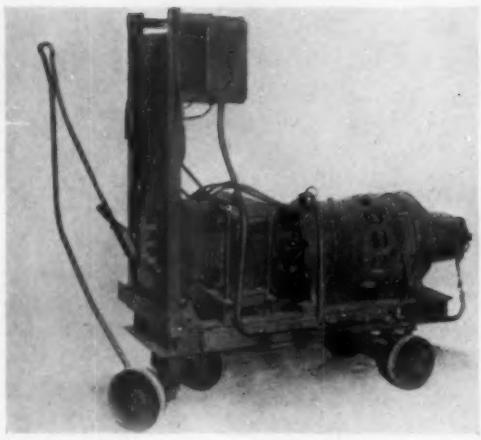
BRIDGEPORT • CONNECTICUT

ESSENTIAL PRODUCTS . . . TRU-LAY Aircraft, Automotive, and Industrial Controls, TRU-LOC Aircraft Terminals, AMERICAN CABLE Wire Rope, TRU-STOP Brakes, AMERICAN Chain, WEED Tire Chains, ACCO Malleable Castings, CAMPBELL Cutting Machines, FORD Hoists, Trolleys, HAZARD Wire Rope, Yacht Rigging, MANLEY Auto Service Equipment, OWEN Springs, PAGE Fence, Shaped Wire, Welding Wire, READING-PRATT & CADY Valves, READING Electric Steel Castings, WRIGHT Hoists, Cranes, Presses . . . *In Business for Your Safety*

Ancient Arc Welder

AFTER being in continuous use in England for 20 years, a 150 amp arc welding machine was recently brought in for overhauling. It was dismantled, rewound, tested and painted—and is now expected to give another two decades of service. The two pictures show the difference in the ancient machine before and after reconditioning.

At the time this old model was new, arc welding equipment ranging in capacity from 150 to 300 amp sold for $3,000 to $4,000, and coated electrodes were 20c per lb. Today a 400 amp welder can be bought for approximately $550, and the price of coated electrodes has been lowered to around 5c per lb.



Courtesy, The Lincoln Electric Co.

Left: 150 amp arc welder after 20 years of continuous service. On the right is the same machine after an overhauling.

» «

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3834 WABASH AVE. DETROIT, MICHIGAN

Mud Scraper

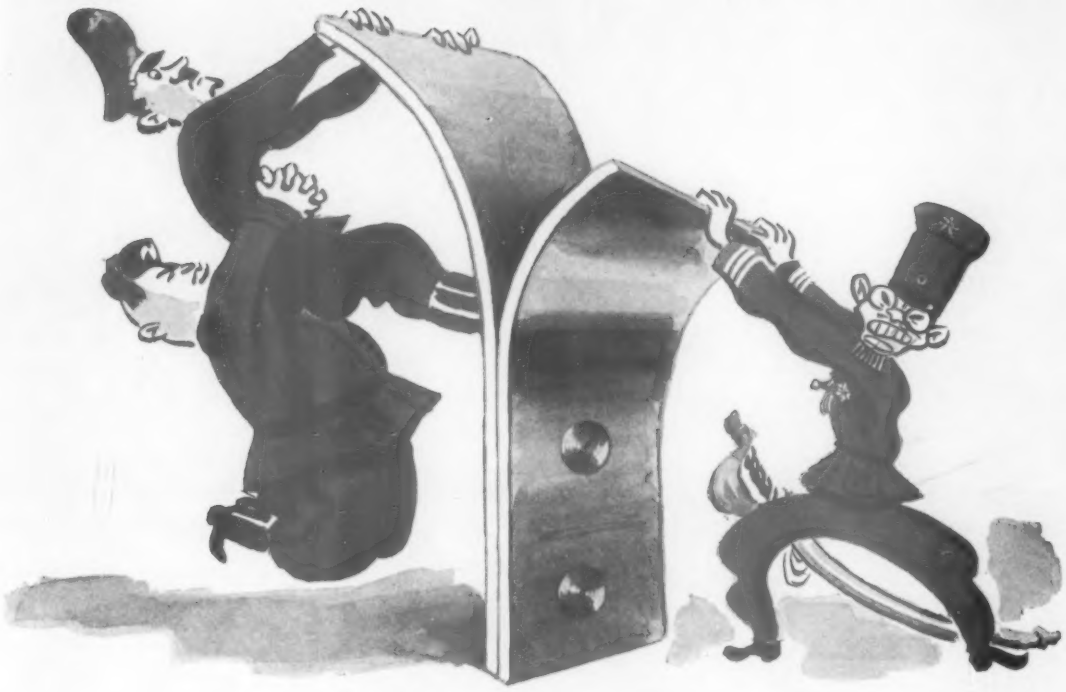
By M. T. PATE

IN PIPE LINE and other construction work in which it is frequently necessary for the truck driver to get out and into mud along with other members of the crew, accidents sometimes occur because the mud on the driver's shoes causes his foot to slip off the pedal at a critical time. To guard against this possibility (and afford a better means of cleaning shoes than the edge of the truck running board), a welded mud scraper was designed for the trucks of one company.

Foot scraper for the running boards of construction trucks. Two vertical stubs of ⅜ in. rod were welded some six in. apart to one end of a 1 by 1 in. ang.e.

The scraper was made from a 20 in. length of 1 by 1 in. angle iron. At one end of the angle was welded a vertical stub of ⅜ in. rod and a second stub of equal size was welded some six inches farther down. A hole was then cut through the other end of the device to permit bolting it to the truck running board. When bolted, the end of the angle carrying the two stubs overhangs the step, as is shown by the accompanying illustration.

This foot scraper does not interfere with normal use of the running board, is self cleaning and may be removed by simply loosening its single retaining bolt.



THE AXIS CAN'T TEAR US APART!

The Sciaky Process is helping fabricate our mighty flow of war materials with STRONG, SOUND, UNIFORM WELDS!.

Adolph, Hirohito and Benito are beginning to feel the sting of our growing air power. However, America's program of 100,000 military aircraft in 1943 calls for faster production methods, stronger structures and fewer rejects.

The Sciaky Process of Electric Resistance Welding is helping to meet these needs with a superior method of spot welding aluminum and its alloys. Utilizing STORED ENERGY, VARIABLE PRESSURE and PRE-HEATING, these exclusive Sciaky features make possible the fabrication of sturdy, primary and secondary stressed assemblies at high speed.

TYPE PMCO. 2S16 SCIAKY ELECTRIC RESISTANCE WELDER. Eighty spot welds per minute on two sheets of light alloy of .040" each. Welding capacity — from two thicknesses of .016" each in light alloys up to .091".

SCIAKY TYPE PMCR. 2S16 ELECTRIC RESISTANCE ROCKER ARM WELDER, welding 70 spots per minute, on two sheets of aluminum alloy of .040" each. Welding capacity from two thicknesses of .016" in aluminum alloys up to and including .080".

SCIAKY BROS.

Manufacturers of a Complete Line of
A.C. and D.C. Electric Resistance Welding Machines.

4915 WEST 67th STREET • CHICAGO, ILLINOIS

Pipe Crossover

By CHARLES C. LYNDE

A BANK of seven pipe lines came from one plant at a height of little more than pipe diameter above the ground. The location was a hazardous one for the occasional worker walking that way as footing on the pipes was by no means secure.

To remedy this condition, the plant weldor was called in to design a pipe crossover. This was fabricated entirely from scrap materials. Two 2 in. pipe lengths long enough to span the seven mains were equipped with clips or straddle irons which slipped over the two outer pipes to hold the framework in place. Between the 2 in. pipe members, short lengths of ⅞ in. rod were welded to form a walkway.

Welded walkway to permit crossing of seven pipe mains.

The crossover was painted black in order to provide contrast with the pipe mains, which had been painted aluminum or white for heat-reflecting purposes. The walkway is readily visible, even at night.

» «

Plate Cutting Shears

A LETTER from Euclides Panichi, Brazilian weldor, tells how he fabricated iron shears for cutting steel plate. "The shears are used to cut steel up to 1⅛ in. thickness," the South American explained. "In the past they were of cast iron construction and were always cracking or breaking. Finally, we were authorized to use welded steel."

Courtesy, The Lincoln Electric Co.

Shears used in Brazil for cutting steel plate. These shears were fabricated and are maintained by arc welding.

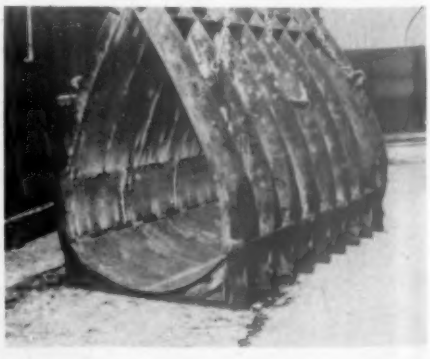
The shears are now fabricated from scrap steel plates, using ⅛ in. mild steel coated electrodes. When the axle is worn out, it is rebuilt by applying several layers of high carbon steel and a finishing layer of abrasion-resistant material.

» «

Arc Welded Die

A DIE approximately 8 ft long, 6 ft wide and 6 ft high was to be built for deforming 78 in. round corrugated pipe into a round-topped arch with flat bottom and straight sides. Though machined and bolted construction would ordinarily have been used, it was decided to build this die by using arc welding.

The die was completed in just 100 hr—40 hr for layout work and 60 hr for welding. It is estimated that a saving of between 40 and 50% was effected by using flame-cutting and welding.



Courtesy, The Hobart Brothers Co.

This big die was fabricated by flame-cutting and welding at a considerable saving over the machined and bolted construction ordinarily used for work of this nature.

SKILSAW DISC SANDERS

Save wasted minutes...

By grinding all metals Faster!

SKILSAW DISC SANDERS—Speed up all grinding, filing, surfacing . . . with cup wheels, wire brushes, sanding discs, etc.

SKILSAW DISC SANDERS—Smooth down welding beads with sanding disc. Flexible pad fits all concave and convex surfaces.

● You'll cut minutes off every surfacing operation with SKILSAW DISC SANDERS on the job. They're faster because they're lighter, more compact, more powerful. And SKILSAW DISC SANDERS do more jobs . . . with grinding wheels, wire brushes, sanding discs, rubbing pads and polishing bonnets. That's why you'll find them *preferred for speed* in welding shops, aircraft, tank and War Plants *everywhere!*

SKILSAW DISC SANDERS do all finishing on flat or curved surfaces of all materials. They grind down welding beads, remove fins and scale from castings, clean metals, sand, file, buff and polish. Ask your distributor to demonstrate SKILSAW DISC SANDERS on your surfacing jobs *today!*

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MECO Equipment Is Producing VITAL WAR MACHINES

☆ On the Production Front . . . on the Battle Front—Meco oxy-acetylene welding and cutting equipment is speeding the day of Victory. ☆ The reliable operation of Meco Safe-T-Chek Regulators reduce production hazards—saves manhours . . . saves time . . . reduces costs. ☆ If you have been disappointed on deliveries of Meco Equipment, bear in mind that every shipment we make is based on the Victory Cause. Meco Equipment is vital to war production. Oxy-Acetylene Cutting and Welding outfits are standard equipment of all of our armed forces, including the ships at sea.

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WELDING AND CUTTING EQUIPMENT

MODERN ENGINEERING CO.

3413 PINE BOULEVARD ST. LOUIS, MISSOURI

New Products to Use

A-C Welders

★ Allis-Chalmers announces its new **Ampac "200"** A-C arc welder, for which a number of distinctive features are claimed. Instead of maintaining an almost constant voltage at all current settings, this new welder automatically corrects the voltage as the current is changed over the continuous range of current available, which is from 30 to 250 amp. Thus welding is easier at low currents because of the high arc striking voltage, but power is saved when welding at high currents because the voltage is then comparatively low.

Another special feature is the integrated reactor-transformer construction in which reactor coils surround a variable air gap. This is said to assure active duty from every line of flux and provide the high voltage needed for easy welding at low currents.

The Ampac "200" handles 1/8 to 1/4 in. electrodes and may be used for welding either thin sheets or heavier plates. Most D-C electrodes can be used (as well as all A-C) because of this welder's unusual arc stability, states manufacturer. Further details are given in Bulletin B6241-A, which can be obtained by writing to the **Allis-Chalmers Mfg. Co.**, Milwaukee.

Ampac "200". It adjusts voltage to current automatically over the full range of current from 30 to 250 amp.

Brazing Alloy

★ **No. 1906 Nickel-Silver Alloy** has been brought out for low temperature oxy-acetylene brazing of plain carbon steels, nickel steels, chromium and chromium-vanadium steels, stainless steels, high speed steels and cemented carbide tool steels. It is claimed that joints with a tensile strength up to 110,000 psi can be produced with this new alloy. The union is effected at a temperature of about 1,400 F, thus reducing to a minumum the changes in the structure of the base metal or its properties.

Another application of the No. 1906 alloy is for the joining of dissimilar metals—ferrous to non-ferrous alloys, steel to stainless steel, nickel, Monel or bronze, etc. **Special Welding Alloy Co., Inc.**, 27-33 Jackson Ave., Long Island City, N. Y.

» «

Blue Welding Glass

★ **"Alubro,"** an improved welding glass of blue color, has recently been announced by **Willson Products, Inc.**, Reading, Pa. The blue glass was developed for reducing the yellow sodium glare present in aluminum and bronze welding. For such work, the new glass allows better vision.

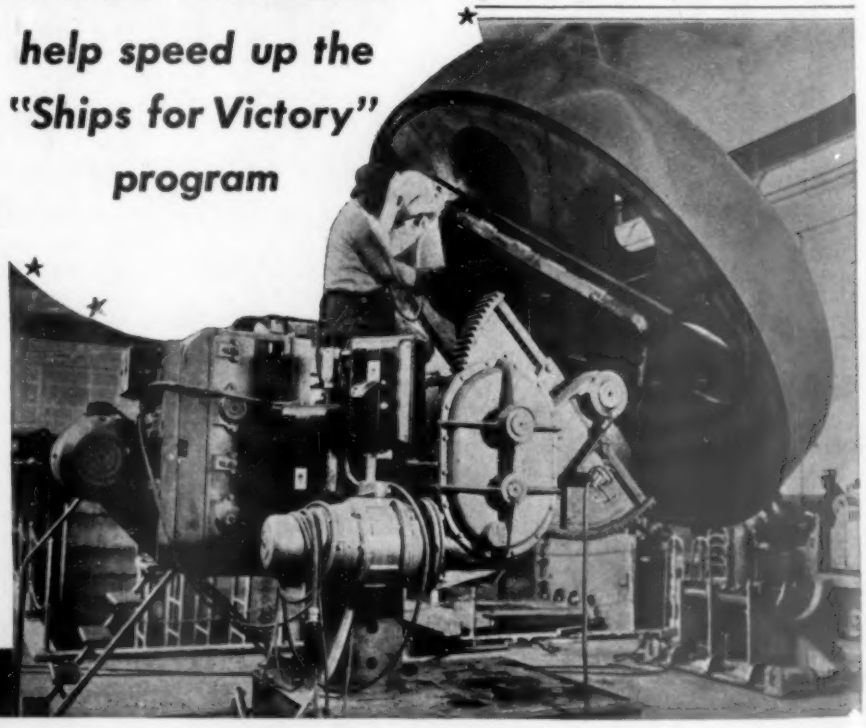
In numerous shipyards and unnumbered plants C-F POSITIONERS are making it possible to weld increasing numbers of parts and subassemblies on a production basis. Take welder shown at right who alone is welding a giant turbine gear blank—every angle and all sides and seams of it welded down-hand. This is possible because his No. 140 C-F POSITIONER tilts (to 135° beyond horizontal) and rotates (360°) this giant weldment at the push of a button. Moreover, the peripheral seams can be made in a single endless weld; for under a variable speed control the entire weldment passes under the rod at exactly the speed desired.

Among the great advances made in welding and welding technique has been the almost universal adoption of Positioned Welding. This has been made possible by C-F POSITIONERS which come in capacities of from 1,200 to 30,000 lbs., in types for every plant or shop.

Write for Bulletin WP 22.

C-F POSITIONERS

help speed up the "Ships for Victory" program



CULLEN-FRIESTEDT CO.,
1308 S. KILBOURN AVE. CHICAGO, ILLINOIS

For Better Welding With Alloy Steels You Need Unamatic

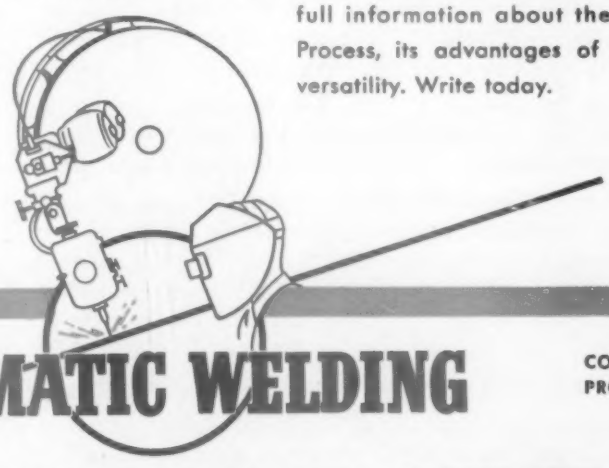
IN the Unamatic Process of shielded arc welding lower heat with consistent rate of travel prevent concentration of stresses which is the cause of buckling in high tensile and alloy, especially stainless, steels.

The close control of all variables, which is the outstanding principle of Unamatic welding, is the reason for the uniformly better welds obtained by Unamatic users with specidl steels.

The Unamatic Process using low heat and multiple passes not only avoids dilution of weld metal due to excessive heat but anneals and improves the texture of the weld metal and thus insures maximum strength in the weld.

As alloy electrodes cost up to a dollar or more per pound the elimination of stub ends is both a very important saving in cost and a conservation of critical materials.

If you are considering automatic welding get full information about the Unamatic Process, its advantages of range and versatility. Write today.



CONTROLLED QUALITY

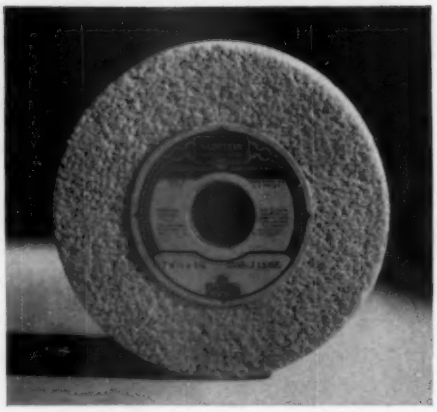
UNAMATIC WELDING

CONTINUOUS PRODUCTION

UNA WELDING INC. • 1615 COLLAMER AVE. • CLEVELAND, OHIO

Grinding Wheel

★ A new **"open structure"** grinding wheel, No. 12 structure, is announced by **Norton Co.**, Worcester, Mass. It has large pores — obtained by a special adaptation of the "controlled structure" process of manufacture—and is stated to be particularly adapted for jobs requiring comparatively heavy stock removal or extra coolness of cut or both. The big pores of this wheel allow a rapid cutting action without burning; grit size for grit size, however, it will not give as good a final finish as the No. 5 or No. 8 structure wheels. A good plan for tool grinding, manufacturer suggests, is to remove stock rapidly with the No. 12 structure wheel and then give the cutting edge a high surface finish with fine grit grinding wheels.



No. 12 structure grinding wheel. Its cool cutting action is especially helpful if stock must be removed rapidly without burning.

» «

Safety Goggles

★ A new "Ful-Vue" safety goggle with 6.00 curve clear "Super Armorplate" lenses to protect the eyes of women workers on the industrial war front is announced by the **American Optical Co.**, Southbridge, Mass. Specifically designed

This new AO safety goggle combines efficient eye-protection with a high degree of all-round visibility, comfort and looks.

to fit the smaller features of women, the new **F3142 Ful-Vue** goggle is made in 42 mm eye size. Three bridge sizes are available: 19, 21, and 23 mm. The double-braced bridge is designed for long life under hard usage. Earpieces have perspiration-proof insulation so that no metal touches the skin.

The lenses are deep curved for extra strength and are made from high quality ophthalmic crown glass, optically ground and polished. Toughened by a highly efficient method of annealing, these lenses are said to be fracture-resisting to the highest practicable limits obtainable by modern science.

» «

Fire Preventive

★ Weldors and others working near sparks or flames may now easily have the protection of fireproof clothing, it is stated by **The Wolfe-Kote Co.**, 705 Center Ave., Sheboygan, Wis. This concern has just placed on the market a water soluble powder known as **"Flame-Pruf"** to prevent cloth and fabric from igniting. The clothes to be fireproofed are simply rinsed in a solution of this material and allowed to dry, when they can be ironed or pressed as before. After drying, the treated clothes will not ignite even if exposed to actual flames; though the cloth will char if exposed long enough to flames, it will not ignite even under these circumstances, asserts manufacturer. The powder is packed in 1 lb packages for home use and in 10 lb cartons for industrial use. It is said to be non-injurious to woolens, cotton or rayon and to the skin.

SMALL

but MIGHTY

Small Portable Hand Pliers Exert 200 P. S. I.

In spite of the diminutive size and 3 ounce weight of these pliers it takes only a normal person's grip of the handle to exert the astounding pressure of 200 lbs. per square inch at the jaws.

That is why this Model KL 436 has become so popular among aircraft manufacturers. Its small size coupled with its almost unbelievable performance lifts it above the average plier.

Knu-Vise Toggle Action Clamping Fixtures save time. They do not require the time-consuming operation of adjusting the pressure for each clamping operation by hand. Once set, the pressure spindle remains in a fixed position until the entire clamping job is completed. The pliers are handled as simply as regular pliers.

Knu-Vise Pliers range in throat capacity up to 5½ inches.

Our broad experience in engineering methods for holding parts or assemblies for various operations is at your command.

KNU-VISE INCORPORATED

1336 Plum St., Detroit, Mich.
4328 San Fernando Rd., Glendale, Calif.

Uncle Sam's ships, planes, tanks and guns will furnish plenty of fireworks on the battle fronts this 4th of July. On the production front the flash of the welding arc makes a display which casts its reflection over the enemy.

Champion electrodes will speed up your output of the weapons our fighting men need for Victory. Champions give you a quiet, steady arc, deep penetration and easy slag removal. You can burn them down to the very end and be assured of a sound deposit without porosity.

THE CHAMPION RIVET COMPANY
11500 Harvard Avenue, CLEVELAND, OHIO
EAST CHICAGO, INDIANA

Fluxes for Aircraft Welding

★ Designed primarily to supply the aircraft industry and its suppliers are four new welding and brazing fluxes. All of these meet U. S. Navy and Army Air Corps specifications.

Superior No. 6 is a silver solder paste flux for brazing and silver soldering all ferrous and non-ferrous metals except aluminum. It becomes completely fluid at 1,100 F. This flux contains no free hydrofluoric acid, manufacturer emphasizes, and so cannot give off objectionable hydrofluoric acid fumes.

No. 7 is a flux designed for the torch welding of stainless steel and similar chrome-nickel steel alloys. It is said to have unusual penetrating qualities.

No. 8 is an Inconel torch welding flux produced primarily for the torch welding of such aircraft parts as mufflers and exhaust manifolds. This flux is stated to have excellent wetting and penetrating qualities and to successfully scavenge the oxides created during welding.

No. 9 is a new aluminum flux for the torch welding of sheet and cast aluminum, aluminum alloys, duralumin, etc. It may also be used for magnesium and magnesium alloys. This flux dissolves aluminum oxides (which form immediately when the metal has been brought to welding heat) and keeps them out of the weld metal. It is said to have good welding qualities.

Superior Flux Co., 913 Public Square Bldg., Cleveland.

Bucket teeth veterans

NOW FULL OF YOUTH!

GOOD AS NEW! That's what you'd say about these worn bucket teeth after they had been salvaged with Coast Metals Hard-Facing! In fact, they are now *better than new.* Because Coast Metals Hard-Facing makes them extra-resistant to abrasion and wear, they will outlast and outwear ordinary teeth several times.

A trial will convince you that Coast Metals Hard-Facing can't be equalled for keeping equipment constantly on the job without unnecessary time out for repairs or replacements. Application is simple—either by the electric welding arc or the oxy-acetylene torch—to new or worn equipment parts of any ferrous metal, including manganese steel, alloy steel, cast iron and chilled iron.

Tell us your wear-resistance problem. Coast Metals Hard-Facing can help you make your equipment last longer

COAST METALS, INC.

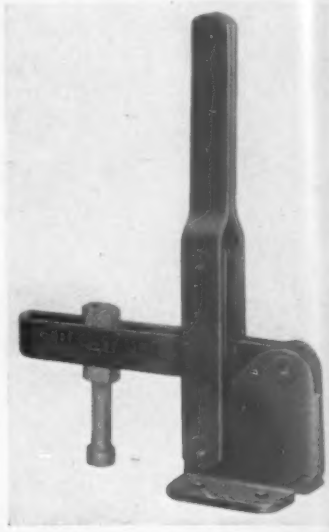
Plant and General Offices: Canton, Ohio • *Executive Offices:* New York, N.Y.

COAST METALS *hard-facing weld rods*

YOUR EQUIPMENT'S LIFE PRESERVER AGAINST WEAR

Small Toggle Clamp

★ Recently added to the "De-Sta-Co" line of toggle clamps is a new small,



Small "De-Sta-Co" toggle clamp for use in aircraft construction or on other work where clamping space is limited.

light duty clamp measuring 5½ in. in overall height and having a base 1¾ by 1¾ in. It is made in two styles: Model 207S with solid straight bar and Model 207U with U-shaped bar. Length of bar from handle to tip is 2¼ in. **Detroit Stamping Co.**, 372 Midland Ave., Detroit.

These cylinders for high pressure gases and liquids range in capacity from 20 to 646 cu in. They have recently been made available for general use on lower priorities.

High Pressure Cylinders

★ Steel containers for high pressure gases and liquids, designed and produced by **Walter Kidde & Co.**, Belleville, N. J., have recently been made available for general use on lower priorities. Made of alloy steel with round bottoms, necked and threaded to specifications, these containers are in full accordance with ICC regulations. The cylinders are cut from sheet steel as discs, which are drawn in successive steps until they reach the required specifications. New drawing methods and metallurgical treatment are said to give strengths designed for working pressures up to 1,800 psi combined with comparatively light weight. The weights of empty containers range from 1½ lb. for the 20 cu in. size up to 21 lb for the 646 cu in. capacity.

When you're BREAKING SHIPBUILDING RECORDS -you can't spare the cables

Day after day more and more Liberty ships are built to offset the U-boat menace. Important in speeding up the nation's shipbuilding program has been the widespread use of welding; and important in the welding operations are Belden welding cables.

Belden cable has made important contributions to this program—it has great flexibility to make welding operation easier—and reduce fatigue of the welders on the job. Its tough insulation has stood up in service over the hot steel plates to provide longer cable life and save time losses due to frequent replacements.

Belden Manufacturing Company
4677-A W. Van Buren St., Chicago, Illinois

Belden WIRE

Awarded the U. S. Treasury Special Citation of Merit for initiating the War Bond-or-Cash Dividend Plan

Thousands of feet of Belden cable are used by the Henry Kaiser shipyards. It is used in many welding operations from laying the keel to adding the finishing touches before launching.

Tamperproof Extinguisher

★ To help eliminate sabotage due to "doctored" fire extinguishers, **American-LaFrance-Foamite Corp.**, Elmira, N. Y., has introduced a new fire-extinguisher case which reveals at once any attempt that may have been made to tamper with the extinguisher it contains. This new **"Tampless Case"** is constructed of cardboard and sealed with a gummed paper sealing strip. Case may be removed instantaneously for legitimate use by pulling the string which breaks the seal.

» «

Dust Collector

★ A new portable dust collector known as the **Bargar "Safe-Aire"** has just been developed to provide a flexible and comparatively inexpensive dust-collection system for grinders or other dust-making machines. It has a capacity of 600 cfm and will normally handle the dust from two 9 in. grinding wheels, whether they are mounted together or separately. The dust-laden air is forced at high speed into a miniature "cyclone" which precipitates the heavier dust into a hopper and throws the lighter dust into a filter chamber. The air is then forced through a spun glass, replaceable filter, after which it passes back into the shop.

The "Safe-Aire" is powered by a ⅓ hp motor, running a blower at 3,400 rpm. It weighs under 120 lb and is installed without piping other than the short length required to attach the dust collector to the machine guard or hood.

"Safe-Aire." Its basic use is to collect dust from a single grinder or other dust-making machine, separate the dust from the air and blow the cleansed air back into the shop.

Requests for further information should be directed to **Ralph Maitland**, 435 Penton Bldg., Cleveland.

» «

Varnish Remover

★ **Sterling S-159 Stripper** was designed to provide fast removal of insulating varnish from portions of electrical equipment where varnish is not desired. It is a blue viscous liquid which is brushed on machined surfaces or other metal parts prior to the application of the varnish to the piece as a whole. After drying, any varnish which may have adhered to the portions previously treated with the stripper can be easily removed with a wood or bakelite knife. **The Sterling Varnish Co.**, 177 Ohio River Blvd., Haysville (suburb of Pittsburgh), Pa.

Sterling stripping liquid eliminates the tedious scraping methods heretofore employed in removing insulating varnish which may have splashed on apparatus parts that should be varnish-free.

"BIG INCH" Speeds to Completion

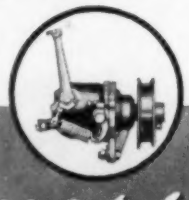
PHOTOGRAPH COURTESY THE LINCOLN ELECTRIC CO.

● To speed 300,000 barrels of oil a day to the Atlantic Seaboard, this famed 24" pipe line is being pushed across the country in record time. It takes fast, sure welds—strong and leak proof—"penny" wide and "nickel" high.

And here again Pierce Flyball Governors are giving the close, sensitive regulation that welding machines *must* have for perfect welds. Their action is positive . . . assuring *unfailing* recovery of current characteristics within 3/10 second after striking arc. Insist on Pierce Flyball Governors now . . . and after the war . . . to regulate your welding operations!

THE PIERCE GOVERNOR COMPANY
1607 OHIO AVENUE, ANDERSON, INDIANA

To be sure of the weld, be sure of the governor. Pierce Flyball Governors are precision-built, speed regulating devices of absolute dependability.



HOW TO MAKE YOUR GOVERNORS LAST!

Like others manufacturing for war needs, Pierce production is for war and essential industry. For this reason new governors can be supplied only on a priority basis. But Pierce calls attention to these easy measures which will make your present Pierce Governors last and give the best service.

- **CLEAN GOVERNORS** once a month with kerosene, gasoline, or prepared cleaner.
- **INSPECT AND CHECK GOVERNORS** each week when in continuous operation.
- **CHECK OIL LEVEL** every day in manually lubricated governors. SAE 20 is recommended at this time of year.
- **LINE UP** driving pulleys or gears accurately when reassembling governor after cleaning.

Should your governor need repair or reconditioning send it to the factory with the necessary preference rating certificate.

Pierce Governors

STANDARD SINCE 1913

HERCO VARIABLE CORE ARC WELDERS

MODELS FROM 150 TO 1500 AMPERES WITH OR WITHOUT POWER FACTOR CORRECTION

for:

24 hour per day operation.
Exact heat control.
Increased production.
Lower power costs.
X-ray test welding.
Ease of operation.

Inquire about MAGNETIC CLAMPS for quick positioning and alignment.

HERCULES ELECTRIC & MFG. CO. INC.

MANUFACTURERS OF THE PRECISION WELDER WITH THE

STREAMLINED ARC

hercules 2416 ATLANTIC AVENUE • BROOKLYN, N. Y. hercules

(Trade Mark Registered)

Specify Titan Welding Alloys

TO ASSURE UNIFORMLY SOUND, STRONG, DUCTILE BRONZE WELDS

Doubly-Deoxidized Welding Alloys:

PENN BRONZE

TITAN BRONZE

TITAN MANGANESE BRONZE

Doubly-Deoxidized PENN BRONZE, TITAN BRONZE and TITAN MANGANESE BRONZE Welding Rods have proved their definitely superior welding qualities over a period of many years and under the most exacting requirements.

The Double-Deoxidization process, developed by Titan engineers, definitely increases the ductility of the weld metal, reduces fuming to a minimum and assures a sound, dense, strong weld.

Descriptive literature sent upon request

TITAN METAL MANUFACTURING CO., BELLEFONTE, PA.

TITAN WELDING RODS

Helpful Literature Just Published

The following reviews are of recent publication of interest to those in the welding industry. Unless otherwise stated, they may be obtained without cost by writing to the manufacturers listed.

Pamphlets on Absenteeism

Two studies of methods for controlling the vital problem of absenteeism have been published by Government agencies. **"Controlling Absenteeism—a record of war plant experience"** is a comprehensive 64-page, 6 by 9 in. book relating the experiences of management in dealing with absenteeism in some 200 war plants. Copies of this publication, Special Bulletin 12, may be obtained on request to the **Division of Labor Standards,** United States Department of Labor, Washington, D. C.

A smaller pamphlet, 30 pages 5½ by 7½ in., has been issued by the WPB's **War Production Drive Headquarters** for the guidance of its labor-management plant committee. This pamphlet, **"Ways of Dealing with Absenteeism as part of the War Production Drive,"** cites methods effectively used in combating the in-plant causes of absenteeism and suggests methods for developing community coöperation in handling other situations which contribute to lost time.

» «

War Agency Handbook

The **"Handbook of Emergency War Agencies"** is a 148-page, 6 by 9 in. publication of the Office of War Information designed to help the public reach the services it needs within the emergency war agencies. This book is a complete guide to those Federal agencies who are devoted in their entirety to war activities. It includes organizational outlines and the names and addresses of officials of emergency war agencies, the War and Navy Departments and the United States Maritime Commission. No attempt, however, has been made to cover the activities of agencies originally established for other than war purposes, even though much of their present work may have been integrated with the War Program. A general index and a 14-page name index are provided for quick reference.

Copies of this handbook are available at 20 cents each from the **Superintendent of Documents,** Government Printing Office, Washington, D. C.

» «

Silver Brazing Bulletin

Useful information regarding the design of low temperature silver alloy brazed joints is given in a four-page, letterhead-size bulletin just issued by **Handy & Harman,** 82 Fulton St., New York City. Diagrams show many examples of both good and bad butt, scarf and lap joints. Mathematical formulas are given for determining the depth of lap or shear area for tubular joints and the length of lap necessary for flat joints in order to conform to a desired safety factor with material of known tensile strength.

» «

D-C Arc Welder Bulletin

Type WD single-operator D-C arc welders are discussed in a 12-page, letterhead size-bulletin, **GEA-1440J,** recently issued by the **General Electric Co.,** Schenectady. The bulletin describes the operation and shows construction details of these engine- or motor-driven welders.

» «

Phos-Copper Brazing

Booklet B-3201, a 12-page, letterhead-size publication, discusses the brazing of copper, brass or bronze joints with phos-copper alloy by each of the four principal methods — the oxy-acetylene torch, incandescent carbon or "tong," electric furnace and dip brazing. Diagrams show the proper designs for butt, scarf, shear and lap joints. Other interesting data are given on the physical properties and sizes and shapes of phos-copper, which comes in rods, ribbons or special shapes for tong and furnace brazing. This booklet may be secured from Dept. 7-N-20, **Westinghouse Electric and Mfg. Co.,** East Pittsburgh, Pa.

Bridgeport laboratory research men are constantly at work to improve the uniformity and quality of bronze welding alloys.

Metallurgically **RIGHT** for the job...

BRIDGEPORT BRONZE WELDING RODS

FACTS for WELDERS ...Practical, up-to-the-minute data. How to select and use bronze welding rods for best results. It is yours free by writing Bridgeport.

You can depend upon the reliable, "workable" efficiency of Bridgeport bronze welding rods because they are made under conditions that assure uniform high quality. Here at Bridgeport constant research and rigid control of production enables us to produce welding rods upon which you may rely with absolute confidence in their efficiency to provide strong, dense, tough welds. Specify "Bridgeport" on your bronze welding rod orders and you can be sure of getting the best in rods, worthy of your skill.

BRIDGEPORT BRASS

"Bridgeport" BRIDGEPORT BRASS COMPANY • BRIDGEPORT, CONN. • ESTABLISHED 1865

Announcing the **NEW**

an EXTRA-HEAVY DUTY WELDER for CONTINUOUS OPERATION

... Power Factor Corrected

G-R 49

Here is a powerful machine built with an oversized core working at low flux densities to provide a generous safety factor *for continuous welding loads.* Model 49, with a welding range of 100 to 675 amperes, has been especially designed to work around the clock, week after week.

Cool in operation (forced ventilation is standard), the G-R 49 handles rod varying from 1/8-in. to 3/8-in. with only a twist of the hand wheel; completely meets every demand for a manually-operated machine for the fabrication of heavy plate.

GLENN-ROBERTS COMPANY

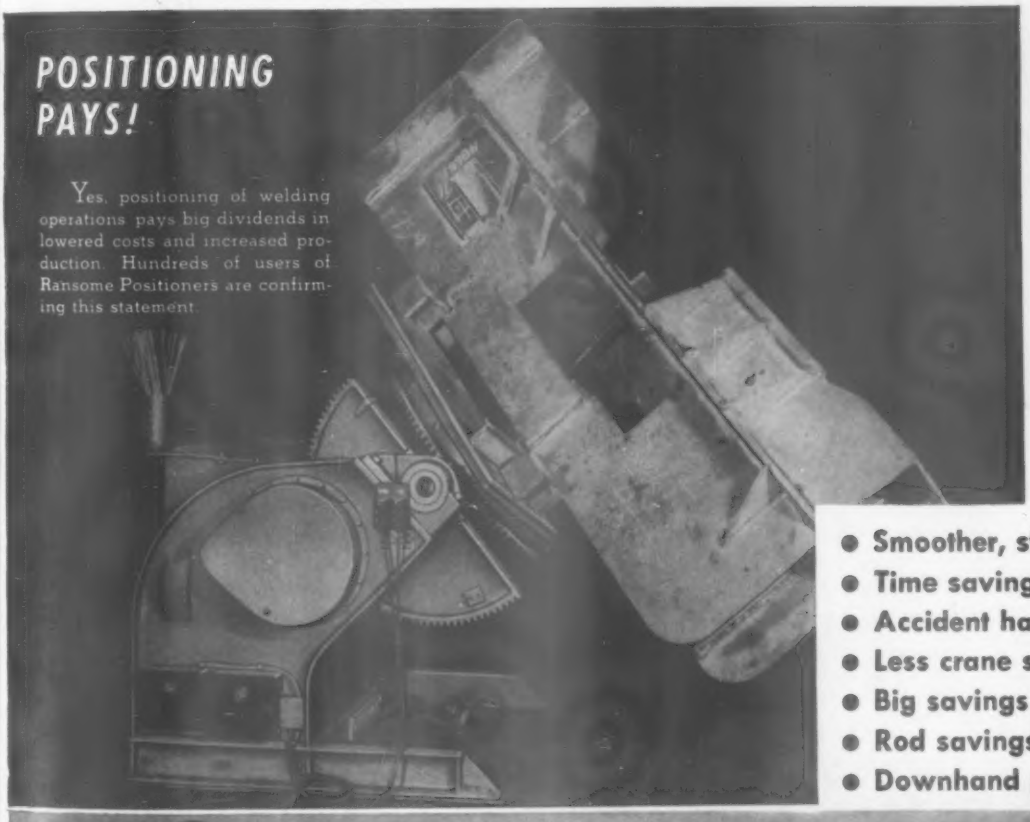
1009 FRUITVALE AVENUE, OAKLAND, CALIFORNIA

2107 ADAMS STREET, INDIANAPOLIS, INDIANA

P. O. Box 1814, Washington, D. C.

POSITIONING PAYS!

Yes, positioning of welding operations pays big dividends in lowered costs and increased production. Hundreds of users of Ransome Positioners are confirming this statement.



Capacity of this Ransome Positioner is 3 tons. Others range from light-duty hand-operated up to 20 tons capacity.

» *Literature on request*

- **Smoother, stronger, welds.**
- **Time savings up to 50%.**
- **Accident hazards reduced.**
- **Less crane service required.**
- **Big savings in floor space**
- **Rod savings up to 7%.**
- **Downhand position for all welds.**

Ransome **WELDING POSITIONERS**

INDUSTRIAL DIVISION • RANSOME MACHINERY COMPANY • DUNELLEN, NEW JERSEY

Arc Welding Chart

"Hot Tips on Arc Welding" is an 11 by 14 in. chart with nine panels describing and picturing the principal "do's" and "don'ts" to remember for safety, speed and economy. A copy for hanging on the bulletin board or elsewhere in the shop may be obtained by writing on a business letterhead to the **Ergolyte Mfg. Co.,** 3629 North Lawrence St., Philadelphia.

» «

Safety Welding Standards

The **Division of Labor Standards,** U. S. Department of Labor, Washington, D. C., has reprinted and is offering to supply copies of the **"Standards for the Protection of Workers in Gas and Electric Welding"** which were originally issued by the Bureau of Hygiene and Sanitation of the New Jersey Department of Labor. Drafted by engineers and welding experts of New Jersey's Industrial Safety Committee, these standards spotlight health hazards due to fumes, dusts and glare as well as accident risks from fire, explosion and shock. Of special interest are the recommended "Safe Practices in Resistance Welding" on page 13, and "Ventilation and Health Protection Standards in Gas and Electric Arc Welding," page 17.

Bulletin on Tubing

Bulletin No. 443, a 12-page letterhead-size booklet on tubing, has just been issued by the **Summerill Tubing Co.,** Bridgeport, Pa. It contains helpful information on many specialties such as tapered and formed tubes and a variety of special shapes. A guide chart for seamless round tubing lists the chemical analyses, mechanical and physical properties for 25 different ferrous and nonferrous metals and alloys, and gives the size range of tubing available in each composition. Booklet is available on request—business letterhead preferred.

» «

Fire Extinguisher Charts

American - LaFrance - Foamite Corp., Elmira, N. Y., announces two new fire extinguisher charts which give complete data in condensed form as to extinguisher and engine characteristics, methods of operation, capacity, range of stream, etc. The charts concisely tabulate the several types of hand fire extinguishers and wheeled engines and state their suitability or otherwise as applying to classes "A," "B" and "C" fires of the Underwriters' Laboratories classification. A Class "D" fire is also added to cover the fire hazards of automobiles, commercial trucks, etc., and a Class "Dt" to cover the fire risks pertaining to tank-trucks and trailer-tractors.

» «

Steel Shapes Data Revised

Second revision of its pamphlet, **"Simplification of Structural Steel Shapes,"** has been issued by the **American Iron and Steel Institute,** 350 Fifth Ave., New York City. The simplified list of structural steel shapes given in the revised pamphlet is that referred to in the WPB Limitation Order L-211, Paragraph (b) of Schedule 4.

» «

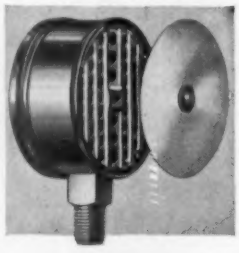
"Frostrode" Bulletin

A six-page, letterhead-size bulletin, **No. P-43,** describes the design, construction and operation of "Frostpoint" permanent spot welding electrodes with replaceable finned "Frostcaps" and of "Frostpoint" adapter holders for converting any spot welder to refrigerated welding. **Frostrode Products,** 19003 John R St., Detroit.

» «

Fire Extinguisher Booklet

An educational booklet titled **"Maintenance of First Aid Fire-Fighting Equipment"** covers the inspection, upkeep, charging, discharging and recharging of various types of fire extinguishers. This booklet is divided into six sections: (1) vaporizing liquid, (2) soda acid, (3) foam, (4) anti-freeze, (5) carbon-dioxide extinguishers and (6) charts giving such data in condensed form as methods of operation, capacity, range of stream, etc. **American-LaFrance-Foamite Corp.,** Elmira, N. Y.



EXCLUSIVE SAFETY FEATURE

The grid-plate shown above is exclusive with Moto Meter Pressure Gauges—an extra safety feature.

MOTO METER **PRESSURE GAUGES** FOR OXY-ACETYLENE APPARATUS

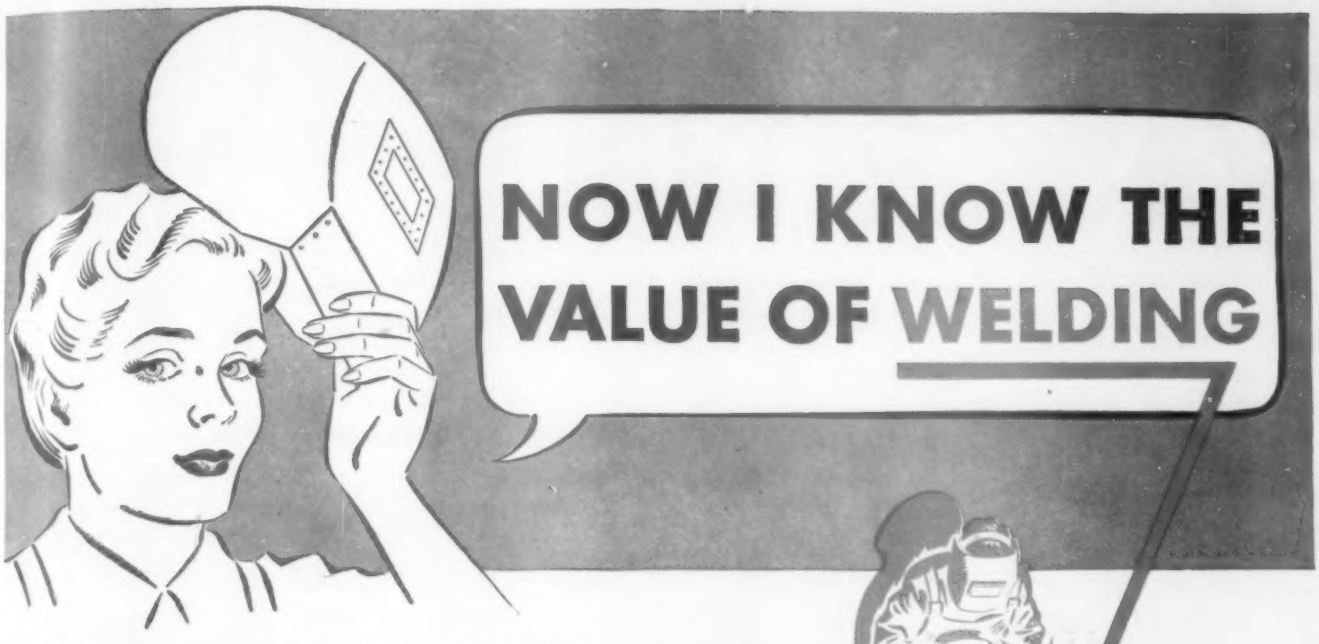
Like magic, the bright flame of the welder's gas torch speeds to accomplishment the tasks of construction, conversion, reconditioning, repair. Serving to maintain oxy-acetylene welding at peak efficiency are Moto Meter Pressure Gauges. Ever-present aids to the welder, they help to insure correct pressures for each job and to conserve vitally needed gas for additional operations.

THE ELECTRIC AUTO-LITE COMPANY

MOTO METER GAUGE & EQUIPMENT DIVISION

CHRYSLER BUILDING, NEW YORK, N. Y.

FACTORY LA CROSSE, WISCONSIN



War has vastly expanded the art of welding. The miracles it is performing under the eyes of men and women welders are building a wide acceptance of its greater value. The amazing progress made under stress of production requirements today, foreshadow the increasingly important part welding will play in building the peacetime world of tomorrow.

FOUR SIZES • SIX TYPES

Welding Range . . . 20-300 Amps.

In hundreds of production and maintenance departments of war plants, and repair shops, Emerson-Electric Portable A. C. Arc Welders are stepping up production and effecting "on-the-spot" repairs. . . . Each welder is built to the same high quality standards, for long service, that have characterized Emerson-Electric products for the past 53 years. Approved by Underwriters' Laboratories. *Available on priority ratings.* Write for prices, specifications, and performance data.

THE EMERSON ELECTRIC MANUFACTURING CO.
ST. LOUIS • *Branches:* New York • Chicago • Detroit • Los Angeles • Davenport

310

Emerson-Electric is now engaged 100% in the production of equipment for War or War Plant Use. In addition to regular products are Power Operated Airplane Gun Turrets, Shell Parts and Electric Aircraft Motors.

EMERSON ELECTRIC

MOTORS • FANS • APPLIANCES • A. C. ARC WELDERS

Stress Relieving Weldments

With Government specifications for weldments becoming more stringent, the need has become imperative for accurately controlled preheating and stress relieving equipment. This new furnace should do any job!

To remove internal stresses in weldments, a large farm implement company has recently completed installation of a new car-bottom-type stress-relief furnace at one of its midwest plants. This furnace, designed and constructed by the Despatch Oven Co. of Minneapolis, has many interesting features.

Fig. 1 shows the heavy-duty heat-insulated car which runs into the furnace on specially leveled tracks. Loaded upon this car, either large or small weldments can be handled rapidly. An electrically operated, tight-sealing door, Fig. 2, slides down a smooth channel to form a union with the car bottom. The wheels of the car remain outside the heat zone.

The "controlled-combustion" convection heat system of the new furnace is designed for fast production. Rapid heat transfer and the effective maintenance of uniform heat in the work chamber permit large scale, automatically controlled processing of a great variety of materials.

What is said to be an unusually close temperature control is accomplished by balancing the heater, fans and circulating ducts on each individual installation. Large fans with special shaft coolers, driven by large motors, are used and each of the graduated posts of the duct system is tested by an anemometer after the furnace is installed. This "metered air" adjustment is said to insure a remarkable temperature uniformity at all heats.

The chief special feature of this new installation is its automatic cycle control equipment which enables the operator to follow any predetermined schedule of treatment by simply setting the dials for the time-and temperature specifications. This control covers complete preheating, soaking and cooling cycles. It should be particularly desirable at the present time, the company management believes, because of the increasingly rigid Government specifications for weldments and for other metal processing work.

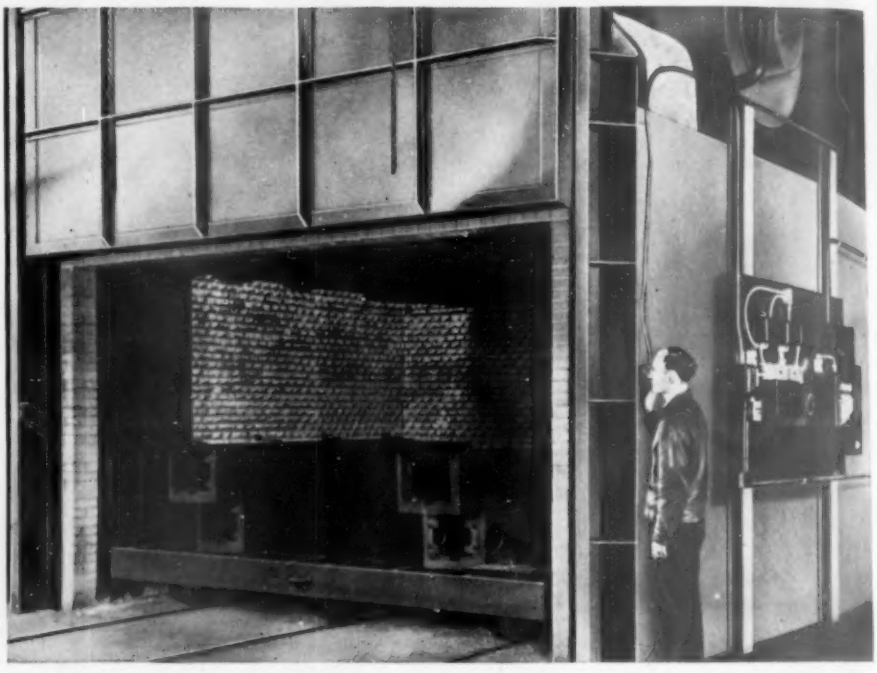


Fig. 1—Weldments are loaded upon this car and rolled into this newly designed furnace for stress relieving at any predetermined time and temperature. The control panel, which covers complete preheating, soaking and cooling cycles, is shown on the right.

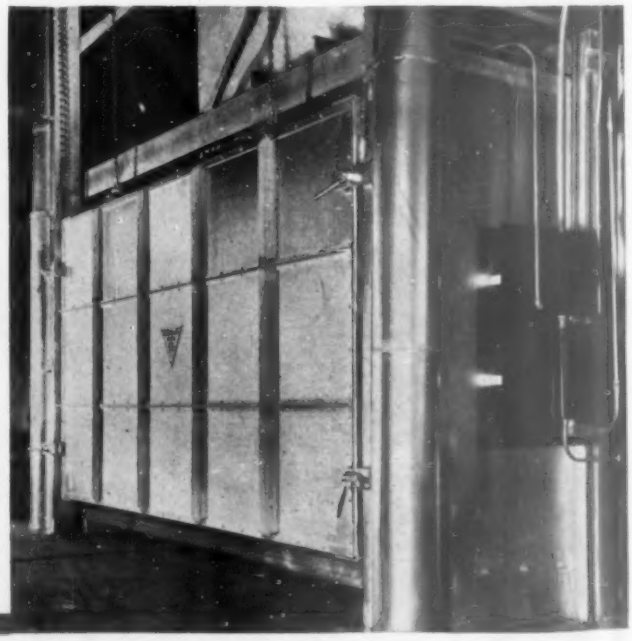


Fig. 2—After the car has been rolled into position, the door slides down to effect a tight seal with the car bottom. The car wheels remain outside the heat zone as shown.

Fire Extinguisher Information

AMERICAN-LaFRANCE-FOAMITE EXTINGUISHER CHART

TYPE			FOAM	CHEMICAL SOLUTION SODA-ACID	ANTI-FREEZING		PUMP TYPE (Anti-freezing or plain water)	VAPORIZING LIQUID		CARBON DIOXIDE
METHOD OF OPERATING			INVERT	INVERT	INVERT	INVERT	PUMP	PUMP	PULL LEVER	OPEN VALVE
METHOD OF DISCHARGING EXTINGUISHING AGENT			CHEMICAL REACTION	CHEMICAL REACTION	CHEMICAL REACTION of capsule	GAS PRESSURE from carbon dioxide cylinder.	HAND PUMPING ACTION	PUMPING ACTION	STORED AIR PRESSURE	PRESSURE STORED IN CYLINDER
EFFECTIVE RANGE OF STREAM			35 TO 40 FEET	30 TO 40 FEET	30 TO 40 FEET	45 TO 55 FEET	30 TO 40 FEET	20 FEET OR MORE under full pump pressure	30 TO 40 FEET	6 TO 8 FEET under full pressure
RATED LIQUID CAPACITY OF MOST COMMON SIZE			2½ GALLONS	2½ GALLONS	2½ GALLONS	2½ GALLONS	5 GALLONS (also 2½ gallons)	1 QUART	1 GALLON	15 LBS.
QUANTITY OF PRINCIPAL EXTINGUISHING AGENT PRODUCED			18 TO 25 GALLONS	2½ GALLONS	2½ GALLONS	2½ GALLONS	5 GALLONS (also 2½ gallons)	Quantity variable — depends upon amount of liquid which comes in contact with heat of fire.	Quantity variable — depends upon amount of liquid which comes in contact with heat of fire.	Quantity variable — about 9 cu. ft. per pound of gas at normal temperature.
NATURE OF PRINCIPAL EXTINGUISHING AGENT			FIREFOAM a mass of bubbles filled with carbon dioxide gas.	LIQUID Soda Solution	LIQUID calcium chloride solution.	LIQUID calcium chloride solution.	LIQUID (plain water or calcium chloride solution).	FREE GAS produced when liquid is vaporized by heat of fire.	FREE GAS produced when liquid is vaporized by heat of fire.	CARBON DIOXIDE GAS AND SNOW
PRINCIPAL EXTINGUISHING EFFECT			BLANKETING	COOLING	COOLING	COOLING	COOLING	SMOTHERING	SMOTHERING	SMOTHERING
IT IS RECOGNIZED AS ADAPTED FOR USE ON	Class A Fires	Wood, Textiles, Rubbish, Etc.	YES BEST AVAILABLE for use in places involving Class "A" fires because of desirable characteristics not possessed by any other extinguishing agent (fireproofing effect; smaller wetting effect, etc.) Must be kept in heated cabinet when installed in places subject to freezing temperatures.	YES for use in places NOT involving oils, greases, etc., in any way. Must be kept in heated cabinet when installed in places subject to freezing temperatures.	YES for use in places NOT involving oils, greases, etc., in any way. DOES NOT REQUIRE PROTECTION AT TEMPERATURES DOWN TO 40 DEGREES F. BELOW ZERO	YES for use in places NOT involving oils, greases, etc., in any way. DOES NOT REQUIRE PROTECTION AT TEMPERATURES DOWN TO 40 DEGREES F. BELOW ZERO	YES for use in places not involving oils, greases, etc. in any way. When Alico crystals are used, does not require protection at temperatures down to 40 degrees F. below zero.	NO Other types are better adapted to Class "A" fires. This type good only under most favorable conditions because of small size; difficulty of confining gas at seat of fire; force, range, and duration of stream not automatically assured; operator cannot devote entire attention to directing stream on fire.	NO Other types are better adapted to Class "A" fires. This type good only under most favorable conditions because of difficulty of confining gas at seat of fire.	NO Other types are better adapted to Class "A" fires. This type good only under most favorable conditions because of difficulty of confining gas at seat of fire, short range of stream. Not useful on overhead fires.
	Class B Fires	Gasoline, Oil, Greases, etc. Flammable Liquids Not Derived from Alcohols	YES BEST AVAILABLE for use in places involving Class "B" fires because of characteristics not possessed by any other type.	NO because it has practically no blanketing effect.	NO because it has practically no blanketing effect.	NO because it has practically no blanketing effect.	NO because it has practically no blanketing effect.	YES but foam type is better adapted to Class "B" fires. This type good only under most favorable conditions because of small size; difficulty of confining gas at seat of fire; force, range and duration of stream not automatically assured.	YES but foam type is better adapted to Class "B" fires. This type good only under most favorable conditions because of difficulty of confining gas at seat of fire.	YES especially so under freezing conditions. Ideal for running or dripping flammable liquid fires.
		Alcohol, Acetone, Ether, Flammable Liquids Kindred to Alcohol	NO	NO	NO	NO	NO	NO	NO	YES Excellent for incipient fires in flammable liquids kindred to Alcohols.
	Class C Fires	Electrical Machinery	NO unless fires have spread beyond the extinguishing capacity of vaporizing liquid or carbon dioxide extinguisher and where current is turned off. The stream is a conductor, but a poor one.	NO except where current is turned off. The stream is a conductor.	NO except where current is turned off. The stream is a conductor.	NO except where current is turned off. The stream is a conductor.	NO except where current is turned off. The stream is a conductor.	YES satisfactory where fires have not spread beyond extinguishing capacity of extinguisher and especially in places where current is not likely to be turned off, because stream is a non-conductor.	YES satisfactory where fires have not spread beyond extinguishing capacity of extinguisher and especially in places where current is not likely to be turned off, because stream is a non-conductor.	YES Stream is a non-conductor, has no wetting, no solvent effect and leaves no residue.
	* Class D Fires	Pleasure Automobiles Commercial Trucks Etc.	NO Unless of special splash-proof construction. Must not be exposed to freezing temperature. Not suitable for pleasure automobiles because of size.	NO has practically no blanketing effect — not splash-proof, subject to freezing. Not suitable for pleasure automobiles because of size.	NO not splash-proof — has no blanketing effect.	NO not splash-proof — has no blanketing effect.	NO because of size; not splash-proof; has no blanketing effect.	YES BEST AVAILABLE for Class "D" fires, because it has smothering effect and is not subject to freezing. On account of its size it can be used on pleasure automobiles.	YES because it has a smothering effect and is not subject to freezing. On account of its size it cannot be used on pleasure automobiles.	YES because it has a smothering effect and is not subject to freezing.
	* Class D-t Fires	Tank-Trucks Trailer-Tractors	YES If of splash-proof construction. Must not be exposed to freezing temperature.	NO not splash-proof — has no blanketing effect.	NO not splash-proof — has no blanketing effect.	NO not splash-proof — has no blanketing effect.	NO has no blanketing effect.	YES because it has a smothering effect and is not subject to freezing.	YES because it has a smothering effect and is not subject to freezing.	YES because it has a smothering effect and is not subject to freezing.
UNDERWRITERS' RATING			A1 - B1	A1	A1	A1	A1 (either size)	B2—C2	B2—C1	B1—C1

* The letters "D" and D-t are for convenience, no letter having been assigned to this class by Underwriters' Laboratories.

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News of the Industry

G-E Releases Training Film on Atomic-Hydrogen Welding

A new all-color sound movie is announced by the General Electric Co., Schenectady, to help in the training of men or women operators using the atomic-hydrogen welding process in war industries. The movie is in two parts, each ten minutes long, and can be used only on sound-equipped 16 mm projectors.

Produced by the Raphael G. Wolff Studios, Hollywood, the new film, "The Inside of Atomic-Hydrogen Arc Welding," follows the general pattern of the successful "The Inside of Arc Welding" films released by G-E last year. Part One describes and illustrates the fundamentals of atomic-hydrogen welding, showing how to regulate the welding current and the hydrogen supply, how to adjust the electrode holder and tungsten electrodes, and how to recognize and correct improper adjustment.

Part Two covers the proper techniques for the principal types of joints and shows how to control the molten pool and how to recognize and correct improper welding conditions. Particular emphasis is laid upon four chief factors—current setting, speed of travel, size of arc, and the contact of the arc with the work.

Each part employs animation, demonstrations by expert operators and close-ups of the "singing" atomic-hydrogen arc in action. Examples are given of good and bad welding.

The film may be obtained for single showings or bought at print cost. For further information, address General Electric's Visual Instruction Section, Schenectady.

» «

Ohio State Establishes New Library on Welding

Making available in one place all of the important literature published on welding, a library on this subject, believed to be the most extensive in existence, has been established at Ohio State University, Columbus.

The new library is located in the same building as the university's welding engineering department and is under the supervision of J. R. Stitt, associate professor of welding engineering. It is known as the "A. F. Davis Welding Library" and is the gift of A. F. Davis, vice-president and secretary of The Lincoln Electric Co., Cleveland.

Though in an early stage of development, this library already contains over 700 books, including books on metallurgy, all the standard welding textbooks and handbooks, bound volumes of technical welding journals, etc. It also contains copies of patents relating to welding and the original manuscripts submitted to The James F. Lincoln Arc Welding Foundation.

» «

Lo, the Poor Indian!

Tom Downing, manager of the New Mexico Steel Co., takes exception to the item on page 80 of the May issue of THE WELDING ENGINEER in which it was stated that there are only six Indian weldors in the United States. Writes Mr. Downing:

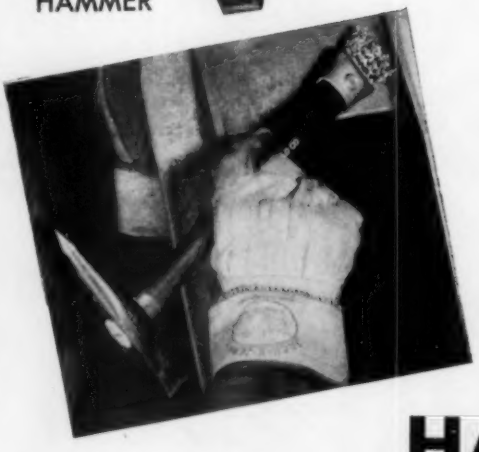
"I am personally acquainted with more than a score of Indian weldors. . . . I number at least a dozen Indians among my regular customers for welding supplies, and some of them are doing responsible work. The fact that a great many Southwestern Indians have taken up welding is not at all surprising when one considers that these people have been doing fine silversmithing for generations. Some of these native mechanics have achieved a high degree of excellence."

TYPE CB
TRIPLE-DUTY
HAMMER

Ask for

CMD

WELDERS' CHIPPING HAMMERS

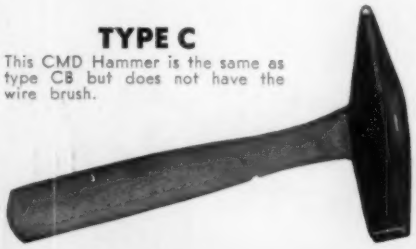


Type CB has a convenient wire brush which can be easily replaced when worn. The head combines chisel and drift. Like all CMD Hammers, it is well balanced for easy use from any position—especially important for cleaning overhead welds. Weight, 16 oz.

The Leader for 18 Years

Because they are light in weight, easy to handle and are durably made of the finest materials including carefully tempered heads that hold their cutting edges longer, CMD Chipping Hammers have been first choice of welders since 1925.

TYPE C
This CMD Hammer is the same as type CB but does not have the wire brush.



Order from your Welding Supply House!
If they cannot supply you, order direct! Descriptive circular sent free upon request.

CHICAGO MANUFACTURING AND DISTRIBUTING COMPANY
Dept. W., 1928 West 46th St., Chicago, Illinois

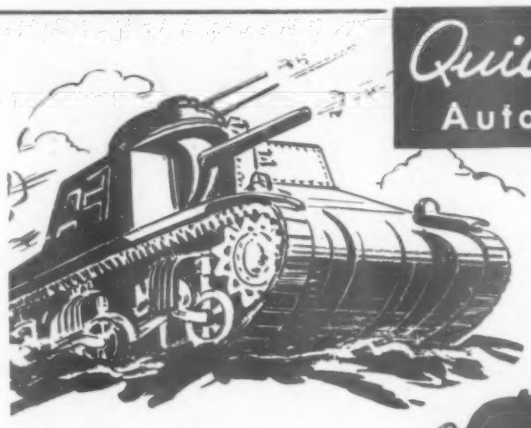
"Sight Feed's my choice"

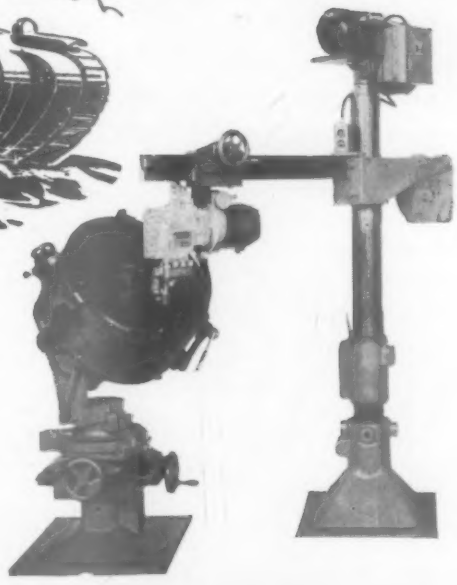
SAYS FRANK HAMMONS OF INDIANAPOLIS

● "Yes, sir, I've had my Sight Feed over four years now. And I figure it's CUT my acetylene costs about three-fourths. Mind you I'm not *tight,* but I am *thrifty*—for, after all, I'm in business to make money. Too, I like Sight Feed's *visible* carbide supply. It never lets me down in the middle of a big job. And Sight Feed is *flexible*—handles *any* torch at *any* pressure! In short, it's just a good all 'round piece of equipment I'd recommend to my best friend."

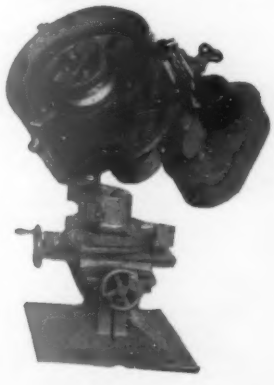
THE SIGHT FEED GENERATOR CO.
Sales: Richmond, Ind., Factory: W. Alexandria, O.

Quicker Welding . . With This Automatic Welding Machine Fixture





Reloading Is done During Welding Operation



THIS Acme dual fixture arrangement permits practically constant use of an automatic welding head, because one of the fixtures can be reloaded while the other is engaged in the welding operation.

The holding machine can be set to revolve at any angle from vertical to horizontal. (Illustration shows a wheel being welded at 45° angle.) Positioner arm swings from one fixture to the other, locking in proper position. Speed of rotating the work is adjustable, as desired.

ACME Manufacturing Co.
1642 HOWARD ST. • DETROIT, MICH.

WRITE

for information. Whatever your positioning problem on automatic welding, let us help you solve it. Write for complete information.

Lincoln Foundation Rewards Engineering Undergraduates

Application of arc welding to the design and construction of a jig for electrical equipment manufacture, an arc welded chair and a radio tower were the subjects of papers for which engineering undergraduates of leading universities received first, second and third awards, respectively, in the Engineering Undergraduate Award and Scholarship Program of the James F. Lincoln Arc Welding Foundation.

In all, 77 awards totaling $5,000 were made to students representing 33 colleges and universities. The students also won 7 scholarships for their universities, totaling $1,750 in value.

The first award of $1,000 and the additional honor of having four $250 scholarships presented in his name to his university's department of mechanical engineering went to Herman J. Brenneke, New York University, New York City. His paper, "Arc Welding versus Casting in the Design of Jigs and Fixtures," showed his own redesign of a jig for welding construction. A saving in cost of $45.18 and a saving in time of 17 hours was indicated.

"An Arc Welded Chair" was the subject of the paper for which Robert Edson Lee, Iowa State College, Ames, Ia., received the Foundation's second cash award of $500 and two $250 scholarships to be presented in his name to the university's department of architectural engineering.

Application of arc welding to the design and construction of a radio tower was the subject of the paper for which Charles L. Sammons and John H. Stewart, Ohio State University, Columbus, O., jointly received the third cash award of $250 and one $250 scholarship.

» «

New "WSR" Ratings Give Actual Welding Capacities

The new "WSR" (Welding Service Range) ratings announced recently by Harnischfeger Corp., Milwaukee, give promise of being an important progressive step in arc welding. Under "WSR," the buyer or user is shown at a glance the exact minimum and maximum limits of a machine's usable welding current range. Since the adoption of these ratings involves no changes in basic welder design, merely new amperage calibration plates, it is expected that other arc welder manufacturers will also utilize the system.

Primary function of "WSR," state Harnischfeger engineers, is to eliminate all guesswork in determining the loads a machine can or cannot handle. Up to now, they explain, the practice has been to give the welder a nominal rating such as 300 or 400 amp. According to prevailing industry standards, the machine is required to deliver its nominally rated capacity for one hour against a fixed resistance load depending upon the size of the machine without exceeding the allowable temperature increase. The buyer is further assured by prescribed standards that the machine has a reserve current capacity of not less than 25% in excess of the nominal rating. Beyond this general guarantee of current delivery, however, the buyer is compelled to discover for himself the machine's actual ability and, until he does so, is unable to make an equitable comparison of values with other machines on a delivered performance basis.

» «

Recommended Standard for Safety Clothing Material

A recommended "Commercial Standard of Materials for Safety Wearing Apparel" is now being circulated to the industry by the National Bureau of Standards for written acceptance. This standard was originally proposed by the Industrial Safety Equipment Association and approved by a conference of safety wearing apparel manufacturers. It was subsequently adjusted in the light of comments from material manufacturers, distributors and users of safety wearing apparel.

In its present form, the proposed commercial standard covers minimum quality requirements for the material used in the manufacture of safety wearing apparel, this material including asbestos fabrics, cotton fabrics (flame-resistant), leather, woolen fabrics, and accessory materials.

WHAT'S SO DIFFERENT ABOUT TWO PIECES OF LEATHER WHICH HAVE IDENTICALLY THE SAME OUTER LOOK ?

LICHTMAN J.L.&S. LEATHERS NEWARK, N.J. TRADE MARK

You undoubtedly have visited other shops producing materials similar or allied to your own. You've seen standardized equipment . . . machines varying somewhat . . . perhaps some methods were different. The grades of supplies used and the ability of the men at work were generally X . . . an unknown equation to you.

In the trades Lichtman has served longest with good performing leathers, competition has followed rather than set standards and examples. Expert skills acquired through specialized production; the use of only upper grades of raw stock; and the founder's principle to make leathers of quality above all else . . . these are the elements which make two pieces of the same appearing leather vastly different under heavy service.

Protective garments and accessories offered by leading supply houses are made of LICHTMAN leathers. Your welders know the difference...just compare leathers yourself and we know your specifications will include our name.

★ ★

J. LICHTMAN & SONS

Tanners of Fine Leathers for 3 Generations

NEWARK N. J.

Miller AC Welders

SPEED PRODUCTION... LOWER COSTS

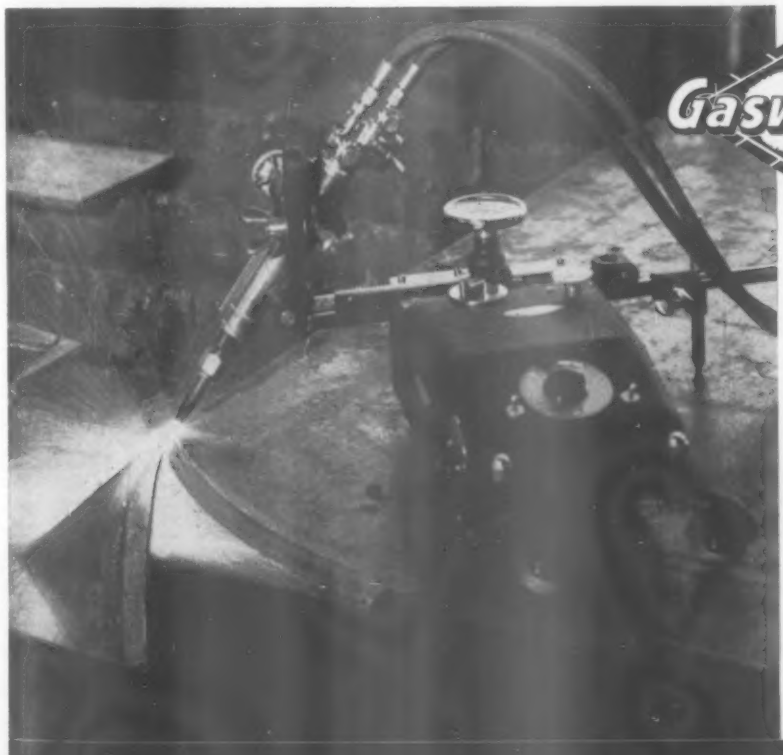
Miller AC Welders are available now in ten models for every shop and industrial need for **BETTER WELDS at LOWER COST**

● Here are some of the reasons why you speed up production and lower costs with Miller AC Welders:

1. It's faster to weld with Miller.
2. Miller AC welds are stronger.
3. You save on electrode costs.
4. Your power costs are lower.
5. Your installation cost is less.
6. You'll have no maintenance costs.

Write for full information about the advantages of Miller AC Welders

MILLER ELECTRIC MANUFACTURING CO.
Sales: Richmond, Indiana • Factory: Appleton, Wisconsin



Gasweld **G-W PORTABLE FLAME CUTTING MACHINE**

● The "Gasweld" G-W Flame Cutting Machine is a portable, motor driven torch for cutting billets and straight lines, strips, circles, arcs or simple irregular outlines in steel plates. Either straight or beveled edge cuts are easily made.

Cuts can be made clean and accurate, eliminating in many cases, the need for further machining. Light, compact—weighing only 45 pounds—the machine is easily moved from place to place in the shop. Speed range—four to sixty inches per minute; travels either forward or in reverse direction.

The G-W Portable Flame Cutting Machine effectively lowers cutting costs and speeds production over hand-cutting methods.

Write for illustrated bulletin and price to

Buffalo, N. Y.
Cincinnati, O.
Chicago, Ill.
Detroit, Mich.
Louisville, Ky.
Milwaukee, Wis.

WALL CHEMICALS DIVISION of
The Liquid Carbonic Corporation
3110 S. Kedzie Ave., Chicago, Ill.

Rochester, N. Y.
Toledo, Ohio
Canada:
Montreal, Quebec
Toronto, Ontario
Windsor, Ontario

Zinc Isn't Poisonous, Asserts Safety Expert

"Zinc is not poisonous in the same sense as lead," it was declared by J. William Fehnel, chemist of the industrial hygiene laboratory of the Metropolitan Life Insurance Co., in a paper presented before the 14th annual safety convention and exposition of the Greater New York Safety Council.

Discussing the subject of metal fume hazards and their control, Mr. Fehnel said:

"Pure zinc has no poisonous qualities, even if ingested in relatively large amounts. It is a constituent of a number of foods: for instance, green corn and oysters, and, therefore, because it is normally taken into the system, it is present in the blood stream and various organs of the body.

"It was formerly thought that zinc metal was the cause of brass founders ague, spelter shakes and brass chills, now classed as metal fume fever. It has been shown that chills and fever can be produced by zinc oxide alone and can also be produced by the inhalation of other metal oxides and finely divided metals. For instance, zinc stearate, magnesium oxide and copper oxide can produce this illness.

"Zinc is not a cumulative poison and a tolerance can be built up."

FOR SMOOTHER WELD GRINDING —3 to 6 TIMES FASTER!

JONES Abrasive Belt SWING GRINDER

You get high-speed weld grinding and smooth, even surfaces with the easy-to-use Jones Abrasive Belt Swing Grinder. This portable unit combines the controlled stock removal feature of a snagging wheel with the smooth surface grinding features of disc grinders.

Speed up your tank grinding 3 to 6 times with the easily portable Jones Swing Grinder, using quick-change, fast-cutting abrasive belts. Readily mounted for covering large areas—simple controls handy to operator—uninterrupted high-speed grinding.

CHECK THESE JONES FEATURES

- High Speed Cutting
- Smooth, Even Surface
- Uninterrupted Grinding
- Easy to Install and Operate
- Quick Abrasive Belt Change
- Perfect Balance at Any Angle
- Reduces Time and Cost

The Ideal Unit for Automatic Weld Grinding—Automatic welding is 2 to 3 times faster than manual operation—why not step up your production line another 2 to 3 times using the Jones Swing Grinder to remove that surplus weld!

WRITE TODAY—
A four-page bulletin "The Jones Abrasive Belt Swing Grinder" gives full details on this time saving, cost-cutting unit. Write for your copy today.

JONES ENGINEERING COMPANY
DEPT. C-1 · ELLWOOD CITY, PA.
Manufacturers of Abrasive Belt Grinding Equipment

Navy Wants Weldors To Serve with Seabees

Skilled craftsmen, including weldors, are urgently needed for enlistment in Class V-6, Naval Reserve, for service in the Construction Battalions or "Seabees," as they are more popularly known. The Seabees are a new breed of sailors who build advance and mobile bases to serve as springboards for America's global offensive. Their name is derived from the phonetic abbreviation "C.B." for Construction Battalions.

With the exception of men in certain vital defense areas, it is now possible for qualified resident citizens of the United States between the ages of 17 and 50½ years to be enrolled in the Seabees in ratings up to and including Chief Petty Officer. Salaries range from $54 to $126 a month (plus 20% for overseas duty), and an allowance of $37.50 per month is provided in the case of a dependent for ratings of Petty Officer 2nd Class.

All applicants must be personally interviewed by a Civil Engineer Corps officer. Full information as to when and where this officer may be contacted can be obtained at local Navy Recruiting Stations.

» «

Pullman Standard Launches Second Sub Patrol Vessel

A second blow at the Axis in less than two weeks was struck May 15 with the launching of the No. 2 all-welded submarine patrol vessel (see page 50) from yards of the Pullman-Standard Car Mfg. Co. at Chicago.

Speaking before several thousand guests and company employes, Rear Admiral H. G. Taylor, superintendent of civil engineering for the Bureau of Yards and Docks in this area, declared it "a wonderful tribute to Chicago industry that its men and shops, a thousand miles from salt water, can produce such splendid craft."

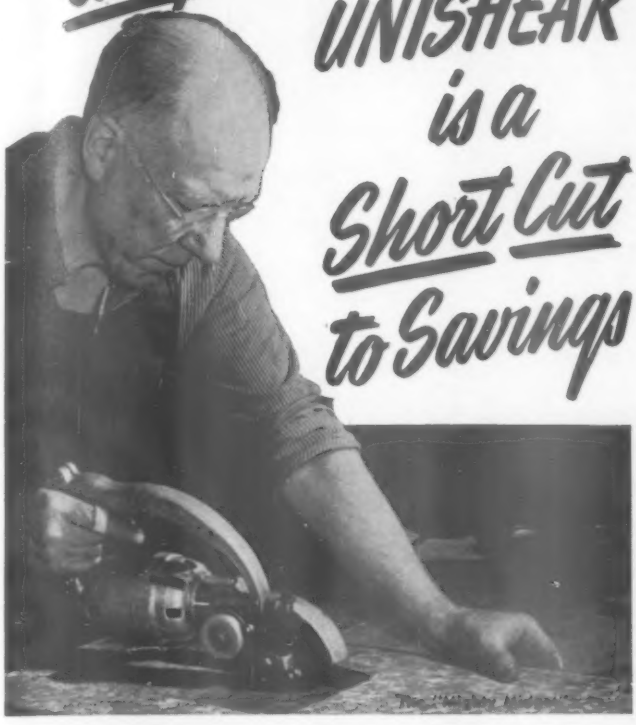
ABOUT PEOPLE

John D. Gordon, formerly general manager of the Taylor-Winfield Corp., is now the general manager of a new concern, the Detroit Electronic Laboratory, 10345 Linwood Ave., Detroit. This company is concentrating on the development and manufacture of special purpose electronic tubes, and it has announced a "Victory Repair Service" for ignitron tubes ranging from 150 to 1,200 kva.

» «

Raymond R. Ridgway, associate director of research for the Norton Co., Worcester, Mass., was awarded the Jacob F. Schoellkopf Medal for 1943 at the May 20 meeting of the Western New York Section of the American Chemical Society at Niagara Falls. He is noted for the isolation and commercial production of boron carbide.

Any Cut with a UNISHEAR is a Short Cut to Savings



SAVE WORK The Stanley "Mighty Midget" and No. 16A portable Unishears are perfectly balanced, easier to handle than snips. Both men and women can cut more metal per day with less fatigue.

SAVE TIME Stanley Unishears cut *fast* – up to 15 feet per minute. Follow any line, cut any shape with hair-line accuracy – straight cuts, curves, angles, small radii. Just plug in wherever the job is – saves moving the work about the shop.

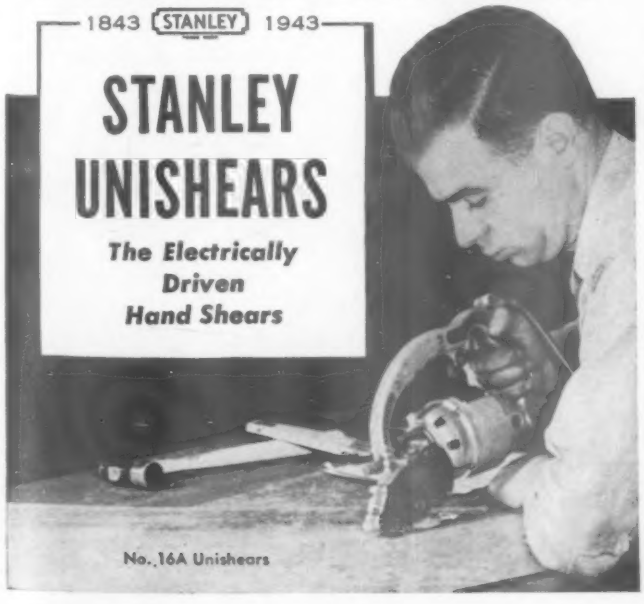
SAVE METAL Unishears leave smooth edges that require no further finishing. There's no distortion of the metal – no waste.

Unishears are helping many war plants make short cuts to new speed records on sheet metal fabrication. Portable models handle up to 12 gauge hot rolled steel – stationary models up to 10 gauge. Stanley Electric Tool Div., The Stanley Works, 122 Elm St., New Britain, Conn.

1843 STANLEY 1943

STANLEY UNISHEARS

The Electrically Driven Hand Shears



No. 16A Unishears

Greater Strength Aluminum Bronze Welding Rods

Produce *Stronger, Longer-Wearing Weld Jobs with*

AMPCO-TRODE

THE *Only* COATED ALUMINUM BRONZE WELDING ROD

With tensile strengths ranging from 50,000 psi. up to 90,000 psi., Ampco-Trode coated bronze electrodes offer maximum strength—often vitally necessary in welding service. Now you do not have to run chances but can select a rod exactly suited to your needs, made from aluminum bronze acknowledged by metallurgists to have highest strength.

Ampco-Trode weldrods also have excellent bearing characteristics—are well suited for overlays on steel and cast iron; building up shafts, wear strips; forming and drawing dies; refacing bearings for extreme wear-resistance.

Made in 7 sizes—⅛" to ½" in diameter. Designed for metallic arc and carbon arc welding and suitable for oxy-acetylene welding.

Where strong, tough welds are needed, try Ampco-Trode coated bronze electrodes. With credit to yourself you can solve that vexing problem of a suitable rod. Ask for Ampco-Trode bulletin. Write today.

AMPCO METAL, INC.

Department WR-6 Milwaukee, Wisconsin

Everett Chapman, president of Lukenweld, Inc., Coatesville, Pa., since 1936, has resigned to establish his own consulting engineering business. He is the author of many publications on various phases of welding and has been much in demand as a speaker before leading technical and industrial societies and associations.

G. Donald Spackman, vice-president in charge of operations of Lukens Steel Co., will be in charge of Lukenweld, Inc., until a successor to Mr. Chapman is elected.

» «

Louis G. Marini has been appointed assistant general manager of the Alloy Rods Co., York, Pa. He was formerly process engineer in charge of production of electrodes for the Westinghouse Electric and Mfg. Co.

» «

W. R. Bernardi, who for the past six years has been in charge of sales of arc welding equipment for Westinghouse Electric and Mfg. Co., at East Pittsburgh, Pa., has now joined the staff of Sciaky Bros., Chicago, as manager of application engineering.

» «

William E. Fry has been placed in charge of the new Kansas City sales office of the United States Steel Supply Co., United States Steel Corporation Subsidiary, at 911 Walnut St., Kansas City, Mo. Mr. Fry was formerly a salesman at the company's St. Louis warehouse.

» «

L. W. Long, formerly sales engineer of the Pittsburgh office of the Allis-Chalmers Mfg. Co., has been appointed sales engineer in charge of mixed apparatus sales at the company's Milwaukee headquarters.

» «

Judson C. Travis, formerly assistant to the president of Handy & Harman, New York City, has been elected vice-president in charge of sales.

» «

John R. Sargent, formerly eastern district market development representative, has been appointed acting manager of the market development department of the Westinghouse Electric and Mfg. Co. He succeeds **Donald C. Hooper,** who is now on active duty in the U. S. Navy.

» «

Lloyd Arnold has been named assistant to the vice-president of finance of the American Steel & Wire Co., subsidiary of U. S. Steel Corp. **Ralph Raymond** has been appointed supervisor of organization planning, succeeding Mr. Arnold.

» «

William J. Basset is retiring from the Lukens Steel Co. after a 31-year association with this concern. Mr. Basset was comptroller of Lukens for the past 17 years.

» «

L. N. Aller, secretary-treasurer, has been awarded the 50-year gold medal bestowed by the Taylor-Wharton Iron and Steel Co. He started working for the company when he was 16 years old and, after going through various departments, became secretary and treasurer in 1930. Fourteen other men now living have also completed 50-year records with Taylor-Wharton, and of these 11 are still in the company's employ.

FLUXING PROBLEMS INVITED

Tell your troubles to Krembs . . . troubles with fluxes used for welding, brazing or silver soldering. Krembs has been solving such problems since 1895 . . . has originated and perfected 89 different non-bubbling, quick flowing Fluxine Fluxes . . . each for specific metal joining purposes. Fluxines Fluxes meet Army, Navy and Air Corps specifications.

Explain your difficulty fully and Krembs will send a free sample with instructions.

KREMBS AND CO.

671 W. OHIO ST. • CHICAGO, ILL.

Chemists and Metallurgists Since 1875

FLUXINE No. 43

For Silver Soldering Stainless Steel, with low melting Silver Solders. Most economical for brazing shells with Silver Solder rings.

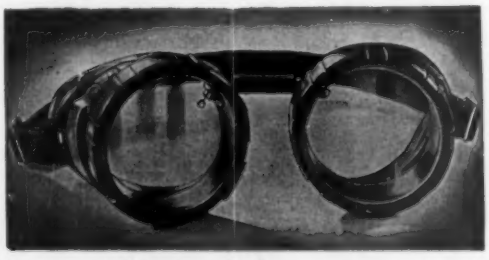
Answers Navy Spec. No. 51-F-4A; Air Corps Spec. No. 11316-A; Federal Ordnance Dept. Spec. No. AXS-500.

TRADE MARK **FLUXINE** REG. U.S. PAT. OFF.

FLUXES TO JOIN ALL METALS

Rido' Ray Welders' Goggles

MADE FOR COMFORT AND SAFETY



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Designed for use under all types of welding helmets—compact, light in weight, providing approved protection against harmful metal fumes—this special Comfo model clicks with the welder's demand for an efficient metal fume respirator suited to his job. Guarded double-seat exhalation valve, twin side-placed replaceable filters, flexible molded facepiece furnish comfort and service already proved by thousands in use. Write for Bulletin No. CR-8!

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Now it's quicker—cheaper—to hard-surface all wearing parts with COLMONOY. Equipment that must take a lot of punishment—perhaps for 24 hours a day—will operate efficiently, with less wear, when the proper grade of COLMONOY is used as a hard-facing for all parts subject to excessive abrasion and corrosion. It will pay *you* to investigate!

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and special information covering specific applications.

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MORTAR	ANTI-AIRCRAFT	ANTI-TANK	155 mm.

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Sure, they all shoot shells. And they're all equally important. But each one does certain jobs better than the others can do it. That's why Uncle Sam's fighters use ALL FOUR!

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Welding Positioners

MM-5
Hand Tilt
Hand Rotation
Indexing rectangular parts at constant angle of tilt

MV-5
Hand Tilt
Variable Speed Rotation
Rotating circular parts at desired welding speed for hand or automatic welding at constant angle of tilt

AM-5
Air-Actuated Hydraulic Tilt
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Indexing rectangular parts and tilting from horizontal to vertical by shop compressed air

AV-5
Air-Actuated Hydraulic Tilt Variable Speed Rotation with power tilt through 90 degrees—the all-purpose machine

ALL FOUR of these Bentley Welding Positioners hold, tilt and rotate a weldment. One of them is operated by hand. One has hand tilt with variable speed power rotation. One has air-actuated hydraulic tilt and hand rotation. And one has air-actuated hydraulic tilt and variable speed power rotation. Possibly you could do all your positioning with any one type (500 lb. capacity, 6 in. above and off center of faceplate). But you could do a better job by selecting one or more of the various types adapted for certain specific jobs. FOR EACH OF THE FOUR DOES CERTAIN JOBS BETTER. And a combination of ALL FOUR will give your shop that EXTRA PUNCH which spells victory on every contract and in the face of any competition.

Write or wire for full description and prices. Prompt delivery.

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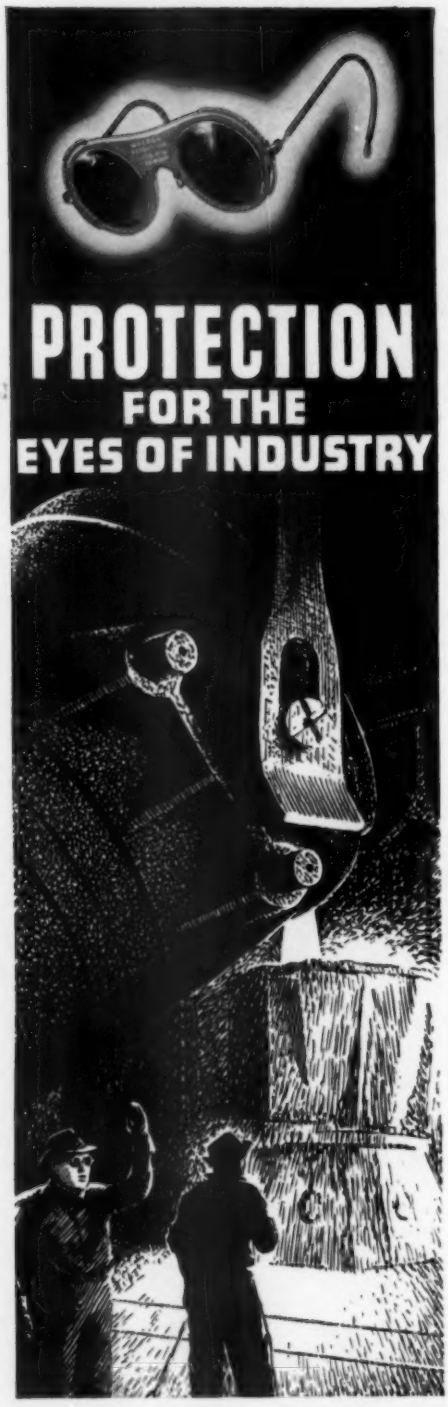
Syracuse, N. Y.



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FOR THE
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In the steel industry, workers' eyes need protection from the damaging effects of infra-red and ultra-violet rays present in the glare from white-hot molten metal. In other industries it may be flying chips, fumes or a combination of hazards. There are over 300 different styles of Willson goggles to provide dependable protection for every conceivable condition. Why not talk to your local Willson Safety Service Representative, or write to us for information?

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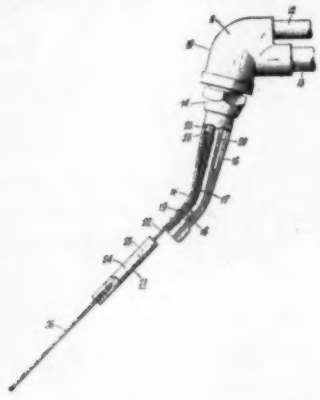
DOUBLE WILLSON
PRODUCTS INCORPORATED
READING, PA. U.S.A.

FROM THE PATENT OFFICE

Tip Cleaning Tool

2,318,696. **Walter R. Linden,** Palisades Park, N. J., assigned to **Union Carbide and Carbon Corp.** Filed Oct. 3, 1940. Issued May 11, 1943.

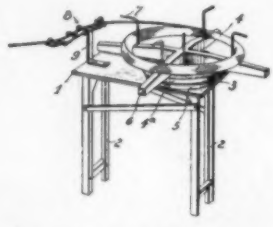


A tool for cleaning both straight and curved gas passages in torch tips. The tool has a handle of substantially round stock of solid material and a piece of multistrand flexible wire cable projecting into a socket at one end of the handle and permanently secured thereto. A portion of the free end of the cable is tapered to facilitate insertion into a gas passage. The strands of the cable are twisted to provide longitudinal grooves between adjacent strands, these grooves serving to receive loosened foreign particles and to remove them from the gas passage.

» «

Metallizing Accessory

2,318,019. **Arthur P. Shepard,** Forest Hills, N. Y. assigned to **Metallizing Engineering Co., Inc.,** Long Island City. Filed April 10, 1941. Issued May 4, 1943.



A device for removing the curvature due to coiling from a metallizing wire feeding into a metal spray gun. The wire is passed between rotatable guide wheels adapted and positioned to guide the wire in a fixed path of travel in approximation of the curvature and between a second set of guide wheels adapted and positioned to further guide the wire in a fixed path of travel in a counter curvature direction sufficient to straighten the wire. The centers of all wire guide spaces (each pair of guide wheels defines a wire guide space) are substantially in the same plane. The wire is fed to and through the orifices between the guide wheels in substantially the same plane.

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"Easyweld"—the all purpose electrode for iron and steel. Specially designed for use with transformer welders—also perform satisfactorily on D-C welders.

"Hevikoat"—SP2 (AWS E6012) straight polarity D-C for poor fit up. RP (AWS E6010) reverse polarity high tensile, high ductility. Approved by American Bureau of Shipping.

"Stainarc"—stainless and corrosion resistant steel electrodes—all analyses.

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"Cast Iron-Arc R"—all purpose. *"Cast Iron-Arc B"* for machinable welds.

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4299 Euclid Ave. Cleveland, O.

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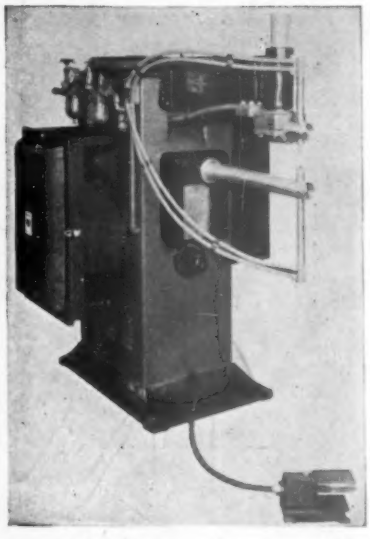

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Seam and butt welders also designed and manufactured.

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FROM YOUR EQUIPMENT

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Automatic Arc Hy-Cycle Unit

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ECONOMICAL
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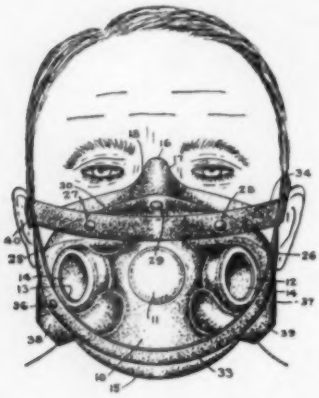
For
Welding and Cutting
Specify
NATIONAL CARBIDE IN THE RED DRUM

NATIONAL CARBIDE CORPORATION
60 E. 42nd St., New York, N. Y.

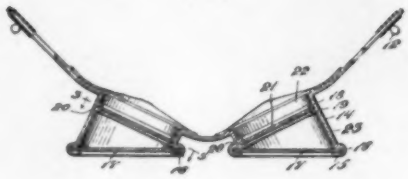
Respirator

2,317,608. **Jay A. Heidbrink**, Minneapolis, assigned to **Air Reduction Co., Inc.**, New York City. Filed Sept. 23, 1941. Issued April 27, 1943.



A mask structure comprising a body portion formed to contact the face of a wearer and provide a breathing chamber. Included are a part for receiving the nose of the wearer and an elongated member secured at its center to the top center of the nose-receiving portion. The latter member is also secured at its ends to portions of the mask at points removed laterally from the central securing means, the extent at each side of the center being less than the underlying distance along the mask surface. The elongated member thereby operates to pull the mask portions at the sides of the nose-receiving part together.

» «



Goggles

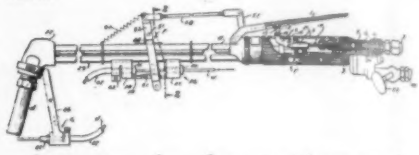
2,317,658. **James W. Welsh**, Providence, R. I., assigned to **Welsh Mfg. Co.**, Providence. Filed Feb. 27, 1941. Issued April 27, 1943.

Goggles having a flexible rubber body for engaging the face about the eyes, a pair of spaced, tubular window-holding portions with axes thereof converging inwardly toward each other when the goggles are properly fitted to the face of the wearer, and a transparent sight window carried by each window-holding portion. Each window has an integral outwardly facing portion, the surface of which in use is arranged to be in alignment with that of the other in a direction extending transversely across the front of the face and at right angles to the normal line of sight of the eyes when the goggles are in position about the eyes. A second window in each tubular portion is located inwardly in spaced relation to the outer window and positioned at an angle to the outer window so that the inner windows approach each other towards the nasal portion of the goggles.

» «

Flame-Cutting Machine

2,317,936. **William Bryce Nicholson** and **Everett P. Jones**, Elizabeth, N. J., assigned to **The Linde Air Products Co.** Filed June 11, 1937. Issued April 27, 1943.



Apparatus for flame-cutting or for flame-machining, desurfacing, deseaming and the like. The torch tip has outlets for delivering a flame adapted to heat a surface portion of a ferrous metal body in order to provide a starting zone and other outlets for delivering an oxidizing gas stream against the heated zone. The feeding mechanism is adapted, when actuated, to advance a small measured portion of fusible and oxidizable metal toward the torch tip. Means are also provided for supporting a supply of the metal and for holding the advanced portions in front of the tip outlets until the portion has been heated to its ignition temperature and burned in the oxidizing gas stream (at the start of the metal-removing operation) to produce exothermic heat. The latter supplements the heat of the preheating flame.

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Hard-Surfacing Welding Electrodes

Make Manganese Steel Wear Longer

SEACO Hard-Surfacing Welding Electrodes now possess a new, improved coating—use them for either AC or DC welding. Conserve Manganese Steel, which is essential to our war efforts: lengthen its life by application of SEACO Hard-Surfacing Electrodes.

Ask for details and name of nearest SEACO distributor.

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W-AL-CO RODS for Welding of ALUMINUM

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Ready fluxed, with the correct proportions of flux on each rod, assuring:

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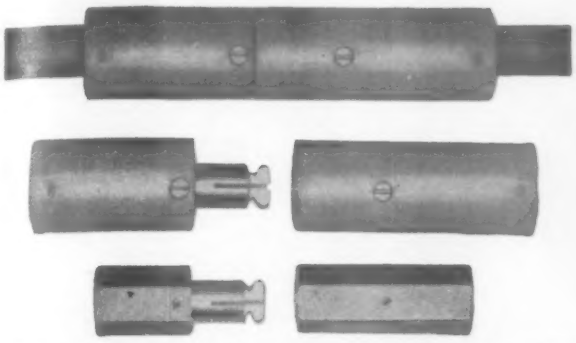
THE ELECTROLOY COMPANY, Inc. 1600 Seaview Avenue, BRIDGEPORT, Connecticut

TWECO CABLE CONNECTORS

Type SOL-CON



TWECO SOL-CON (Solder Connection) Cable Connectors are quick-detachable and interchangeable. The split plug with a "ring groove" locks snugly in the "pin-key" in the female receptacle.

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REVOLVES 360°-By Hand-Crank or Vari-Speed Power

LYON-Raymond Corporation

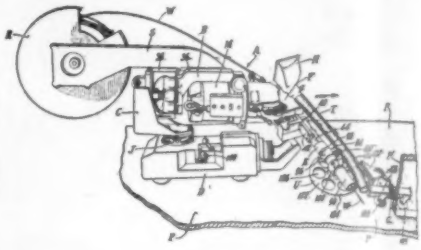
MATERIAL HANDLING EQUIPMENT

233 Madison St. Greene, N. Y.

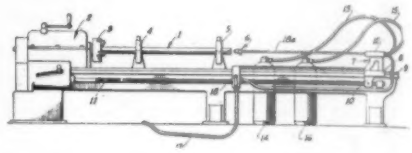
Automatic Welding Apparatus

2,314,917. **Albert W. Baird,** Elizabeth, N. J., assigned to **The Linde Air Products Co.** Filed May 22, 1941. Issued March 30, 1943.

Fillet welding apparatus for submerged melt welding. Included in combination are: a motive device for traversing apparatus along a seam, a welding wire reel, a mechanism for feeding welding wire from the reel toward the seam, means for conducting current to the welding wire, and means pivotally supporting the reel and feeding mechanism for oscillation as a unit in a vertical plane, the weight of reel and feeding mechanism being so distributed that



they tend to tip forwardly about the pivotal supporting means. Also provided is a means for guiding the apparatus along the intersection of the pair of angularly disposed plates which are to be welded together by a fillet weld. The guiding means includes a member secured to the feeding mechanism and rotatably engaging one of the members to be welded.



Flame-Hardening Method

2,318,145. **Frank C. Emery,** Los Angeles, and **Edwin F. Green,** Lynwood, Calif., assigned to **Axelson Mfg. Co.,** Los Angeles. Filed Oct. 30, 1939. Issued May 4, 1943.

Method of flame-hardening the interior surfaces of bores in machine elements. Heat is applied to the interior surface of the bore to bring the surface above the critical temperature, and a cooling medium is applied to confine the effect of the heat to a short cylindrical zone, which is then quenched and hardened. Means are provided for progressively advancing the heated zone along the length of the bore and for rotating the element being hardened about the horizontal axis of the bore.

» «

Tank Welding Method

2,317,734. **George B. Cook,** Summit, N. J., assigned to **Standard Oil Development Co.** Filed Aug. 3, 1940. Issued April 27, 1943.

A method of constructing and welding non-corrosive bottoms of storage tanks which, because of their large size, must be constructed at the permanent site by welding metal plates together there. The method comprises coating adjoining bottom plates with a non-corrosive, heat-and-pressure-fusible plastic material to a line spaced from the plate edges, depositing on a cushioned support for the plates, along their line of junction, a seal of fibrous material impregnated with a coating of the plastic material previously mentioned, and making a metallic weld along the plate juncture with sufficient local application of heat to substantially fuse the seal to the coating material on the under surfaces of the plates.

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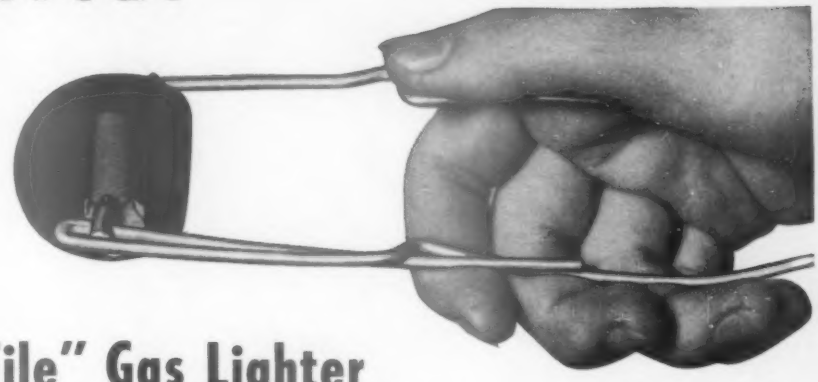

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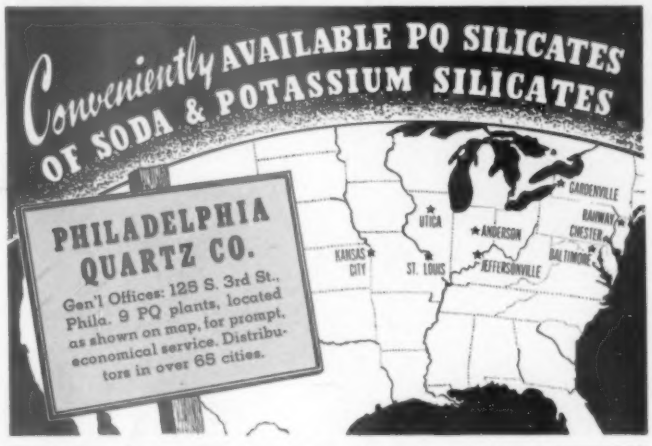

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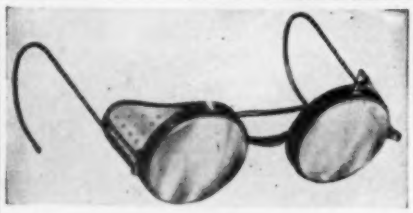

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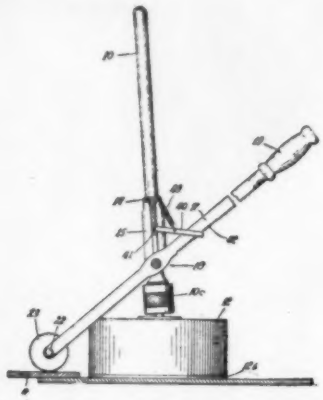
Magnetic Clamp

2,314,788. **John William Innes,** Philadelphia. Filed May 22, 1941. Issued March 23, 1943.

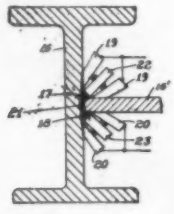


This patent pertains to an electromagnetically energized grappling assembly for attachment to a metal plate. A work-engaging means, adapted to abut an object to be welded to the metal plate magnetically attached to the grappling assembly, is secured to the grappling assembly by a pivotal lever connection. With this lever the work-engaging element and the grappling assembly may be manipulated in opposed directions to draw together the parts to be welded.

» «

Butt Welding Method

2,314,738. **Eduard Schenk,** Oakdale, Pa. Filed May 4, 1924. Issued March 23, 1943.



A method of resistance welding an end of one metal member to the side of another. The method comprises the placing of a metallic filler strip in the angle formed by the members while a flow of alternating current is directed through electrodes across those areas of the members which are adjacent to the sides of the strip and across the abutting areas of the members. The current flow is maintained until the areas affected and the filler metal become soft, and the current frequency is such that there is magnetic concentration of current flow between the abutting areas.

» «

Welding Electrode

2,317,681. **James Fletcher,** Detroit, assigned to **Tipaloy, Inc.,** Detroit. Filed Dec. 15, 1941. Issued April 27, 1943.

A spot welding electrode consisting of a copper alloy body having a plug of silver set in its welding contact face. The face and plug present a flat flush surface.

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